APPENDIX A. LISTING OF STANDARDS CODED: MATHEMATICS

The 12 economies in this study volunteered for participation and have maintained involvement throughout the process, providing English-language copies of their standards, providing data about their students and explaining their educational systems and the approach undergirding their standards. Some economies that otherwise would have chosen to participate could not because an English translation of the standards for comparison was required for the analysis. China and Thailand provided only mathematics standards for this study.

Elementary-Secondary		
Economy	**Title/Publication date**	**Grades**
Alberta, Canada	The Alberta K–9 Mathematics Program of Studies with Achievement Indicators 2007	Primary: Grades 1, 2, 3, 4, 5 and 6
		Middle School: Grades 7, 8, 9
		High School: Pure Math 10, 20 and 30
Australia	Statements of Learning for Mathematics 2006	Primary: Grades 3 and 5
		Middle School: Grades 7 and 9
China	No title page or publication date	Primary: Grades 3 and 6
		Middle School: Grade 9
		High School: Grades 10 & 11 (Math 1, 2, 3, 4)
Chinese Taipei	No title page or publication date	Primary: Years 1, 2, 3, 4, 5, 6
		Middle School: Years 7, 8 and 9
		High School: Years 10, 11, 12 1st year, 2nd year, Elective 1
Hong Kong	Key Learning Area Curriculum Guide 2002	Primary: Grades 1, 2, 3, 4, 5 and 6
		Middle School: Grades 7, 8 and 9
		High School: Grades 10 and 11
Japan	Mathematics for Elementary School Mathematics for Lower Secondary School Mathematics for Upper Secondary School No title page or publication date	Primary: Grades 1, 2, 3, 4, 5, 6
		Middle School: Grades 7, 8 and 9 (Years 1, 2, 3)
		High School: Grades 10, 11 and 12 (Math I, II, III, A, B, C)

Elementary-Secondary		
Economy	**Title/Publication date**	**Grades**
Korea	Seventh National Curriculum 1998	Primary: Grades 1, 2, 3, 4, 5, 6
		Middle School: Grades 7, 8, 9
		High School: Grade 10
Malaysia	Integrated Curriculum for Primary Schools, Integrated Curriculum for Secondary Schools 2003	Primary: Grades 1, 2, 3, 4, 5, 6
		Middle School: Grades 7, 8, 9 and 10
		High School: Grades 10 and 11
New Zealand[1]	The New Zealand Curriculum: Achievement Objectives 2007	Primary: Grades 1, 2, 3, 4, 5, 6 (Levels 1, 2, 3)
		Middle School: Grades 7, 8, 9 and 10 (Levels 4, 5)
		High School: Grades 11 and 12 (Levels 6, 7, 8)
Singapore	H2 Mathematics: Content Outline 2009	Primary: Grades 1, 2, 3, 4, 5, 6
		Middle School: Grades 7 and 8 (O-Levels 1, 2, 3)
		High School: Grade 10 (O-Level 4)
Thailand	Basic Education Curriculum 2001	Primary: Grades 1, 2, 3, 4 ,5 and 6
		Middle school: Grades 7, 8 and 9
		High school: Grades 10, 11 and 12
United States	Mathematics Framework for the National Assessment of Educational Progress (NAEP) 2007	Primary: Grade 4
		Middle School: Grade 8
		High School: Grade 12

[1] *New Zealand presents its "blended" mathematics standards in overlapping bands in recognition of the varying pace at which students master material*

APPENDIX A (CONTINUED). LISTING OF STANDARDS CODED: SCIENCE

Ten APEC economies volunteered for participation in the science portion of this study: Australia, Canada, Chinese Taipei, Hong Kong, Japan, Korea, Malaysia, New Zealand, Singapore and the United States. (Some economies that otherwise would have chosen to participate could not because an English translation of the standards for comparison was required for the analysis.) In addition, secondary level course standards from seven economies are included in the study.

Elementary-Secondary General Science		
Economy	**Title/Publication date**	**Grades**
Australia	Statements of Learning 2006	Grades 3, 5, 7 and 9
Canada	Common Framework of Science Learning Outcomes 1997	Grades 1, 2, 3, 4, 5, 6, 7, 8, 9 and 10
Chinese Taipei	Learning Areas in Science and Technology 2004	Grades 1, 2, 3, 4, 5, 6, 7, 8 and 9
Hong Kong	Key Learning Area Curriculum Guide 2002	Grades 1-3, 4-6, 7-9 and 10
Japan	The Courses of Study in Japan 2004	Grades 3, 4, 5, 6, 7-9, 10
Korea	Seventh National Curriculum 1998	Grades 1, 2, 3, 4, 5, 6, 7, 8, 9 and 10
Malaysia	Integrated Curriculum for Primary Schools, Integrated Curriculum for Secondary Schools 2003	Grades 1, 2, 3, 4, 5, 6, 7, 8, 9 and 10
New Zealand[2]	The New Zealand Curriculum 2007	Grades 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11 and 12 (Levels 1-8)
Singapore	Science Syllabus Lower Secondary Express/Normal Academic 2007	Grades 3, 4, 5, 6, 7, 8, 9 and 10
United States	Science Framework for the National Assessment of Educational Progress (NAEP) 2005	Grade 4, 8, and 12

[2] *New Zealand presents its science standards in overlapping bands in recognition of the varying pace at which students master material.*

Grades 10-12: Science Subjects				
Economy	**Biology**	**Chemistry**	**Earth Science**	**Physics**
Australia				
Canada	X	X	X	X
Chinese Taipei	X	X	X	X
Hong Kong	X	X		X
Japan	X	X	X	X
Korea				X
Malaysia	X	X		X
New Zealand				
Singapore				
United States				

APPENDIX B: TOPICS COMMON ACROSS ECONOMIES
MATHEMATICS GRADES 1-12
ORGANIZED BY CODING FRAMEWORK

The set of common topics in mathematics consists of the mathematics content included in the coding framework addressed by two-thirds or more of participating economies' standards. The number of economies included in each grade span varies slightly; therefore, the number of economies required for a topic to be included in the set of common topics shifts slightly from span to span. The decision rule for inclusion in the set of common topics is based on a constant percentage: Sixty-seven percent or more of economies included in any given grade span must address the topic in order for the topic to be included.

The topics included in the set of common topics for each grade span are listed below alongside the percentage of economies addressing that topic in their standards grouped into that grade span. The topics are organized by the categories in the framework (number, measurement, etc.).

TOPICS	GRADES 1-6 % Economies: 12	GRADES 7-9 % Economies: 12	GRADES 10-12 % Economies: 11
NUMBERS			
Whole Numbers	8%	8%	0%
Meaning	100%	50%	9%
Operations	100%	42%	0%
Properties of Operations	67%	33%	9%
Fractions & Decimals	0%	0%	0%
Common Fractions	100%	58%	0%
Decimal Fractions	100%	58%	9%
Relationships of Common & Decimal Fractions	83%	67%	0%
Percentages	83%	75%	27%
Properties of Common & Decimal Fractions	17%	25%	0%
Integer, Rational & Real Numbers	0%	0%	0%
Negative Numbers, Integers & Their Properties	17%	100%	36%
Rational Numbers & Their Properties	8%	67%	36%
Real Numbers, Their Subsets & Properties	33%	92%	73%
Other Numbers & Number Concepts	0%	0%	0%
Binary Arithmetic and/or Other Number Bases	0%	17%	0%
Exponents, Roots & Radicals	0%	92%	64%
Real exponents	0%	17%	9%
Complex Numbers & Their Properties	0%	0%	55%
Number Theory	100%	75%	36%
Systematic Counting	0%	17%	45%
Matrices	0%	0%	36%
Estimation & Number Sense Concepts	8%	0%	0%
Estimating Quantity & Size	50%	50%	0%
Rounding & Significant Figures	67%	92%	45%
Estimating Computations	92%	67%	18%

TOPICS	GRADES 1-6 % Economies: 12	GRADES 7-9 % Economies: 12	GRADES 10-12 % Economies: 11
Exponents & Orders of Magnitude	0%	50%	27%
MEASUREMENT			
Measurement Units	0%	0%	0%
Concept of measure (including non-standard units)	100%	17%	0%
Standard units (including metric system)	100%	50%	27%
Use of appropriate instruments	58%	25%	0%
Common measures (Length; area; volume; time; calendar; money; temp; mass; weight; angles)	100%	75%	18%
Quotients and products of units (km/h, m/s, etc.)	42%	33%	27%
Dimensional analysis	8%	25%	0%
Computations & Properties of Length, Perimeter, Area & Volume	0%	25%	0%
Computations, formulas and properties of length and perimeter	92%	92%	45%
Computations, formulas and properties of area	100%	92%	64%
Computations, formulas and properties of surface area	33%	92%	27%
Computations, formulas and properties of volumes	83%	92%	45%
Estimation & Error	0%	17%	0%
Estimation of measurement and errors of measurement	92%	50%	27%
Precision and accuracy of measurement	17%	42%	18%
GEOMETRY: POSITION, VISUALIZATION & SHAPE			
1-D & 2-D Coordinate Geometry	0%	0%	9%
Line and coordinate graphs	58%	92%	91%
Equations of lines in a plane	8%	33%	82%
Conic sections and their equations	0%	17%	55%
2-D Geometry: Basics	8%	33%	9%
Points, lines, segments, half-lines, and rays	75%	92%	82%
Angles	83%	92%	64%
Parallelism and perpendicularity	75%	92%	55%
2-D Geometry: Polygons & Circles	33%	67%	36%
Triangles and quadrilaterals: their classification and properties	100%	100%	64%
Pythagorean Theorem and its applications	0%	100%	55%
Other polygons and their properties	100%	100%	27%
Circles and their properties	100%	92%	82%
3-D Geometry	8%	17%	0%
3-Dimensional shapes and surfaces and their properties	100%	100%	55%
Planes and lines in space	17%	17%	36%
Spatial perception and visualization	83%	83%	55%
Coordinate systems in three dimensions	0%	0%	27%
Equations of lines, planes and surfaces in space	0%	0%	9%
Vectors	0%	0%	45%
Simple Topology	0%	17%	0%

TOPICS	GRADES 1-6 % Economies: 12	GRADES 7-9 % Economies: 12	GRADES 10-12 % Economies: 11
GEOMETRY: SYMMETRY, CONGRUENCE & SIMILARITY			
Geometry: Transformations	0%	0%	0%
Patterns, tessellations, friezes, stencils, etc	67%	58%	0%
Symmetry	75%	75%	36%
Transformations	58%	83%	64%
Congruence & Similarity	0%	0%	0%
Congruence	33%	83%	36%
Similarities (similar triangles and their properties; other similar figures and properties)	25%	92%	36%
Constructions w/ Straightedge & Compass	42%	83%	9%
PROPORTIONALITY			
Proportionality Concepts	0%	0%	0%
Meaning of ratio and proportion	67%	92%	27%
Direct and inverse proportion	25%	33%	36%
Proportionality Problems	0%	0%	0%
Solving proportional equations	17%	33%	27%
Solving practical problems with proportionality	33%	83%	27%
Scales (maps and plans)	67%	50%	27%
Proportion based on similarity	8%	67%	18%
Slope & Simple Trigonometry	0%	0%	0%
Slope and gradient in straight line graphs	0%	33%	82%
Trigonometry of right triangles	0%	50%	100%
Linear Interpolation & Extrapolation	0%	17%	27%
FUNCTIONS, RELATIONS, & EQUATIONS			
Patterns, Relations & Functions	0%	0%	0%
Number patterns	83%	83%	55%
Relations and their properties	0%	17%	27%
Functions and their properties	0%	67%	91%
Representation of relations and functions	17%	83%	100%
Families of functions (graphs and properties)	0%	17%	45%
Operations on functions	0%	42%	27%
Related functions (inverse, derivative, etc.)	0%	0%	55%
Relationship of functions and equations (e.g., zeros of functions as roots of equations)	0%	42%	73%
Interpretation of function graphs	0%	83%	82%
Functions of several variables	0%	0%	0%
Recursion	0%	0%	36%
Linear Functions	0%	92%	64%
Quadratic Functions	0%	50%	82%
Logarithmic and Exponential Functions	0%	17%	64%
Trigonometric Functions	0%	0%	91%
Equations & Formulas	0%	8%	27%
Representation of numerical situations by equations	92%	92%	45%
Informal solution of simple equations	75%	33%	9%

TOPICS	GRADES 1-6 % Economies: 12	GRADES 7-9 % Economies: 12	GRADES 10-12 % Economies: 11
Evaluating expressions	17%	75%	27%
Equivalent expressions (including factorization and simplification)	25%	83%	82%
Linear equations and their formal (closed) solutions	58%	100%	91%
Quadratic equations and their formal (closed) solutions	0%	58%	100%
Polynomial equations and their solutions	0%	42%	73%
Trigonometrical equations and identities	0%	0%	55%
Logarithmic and exponential equations and their solutions	0%	0%	45%
Solution of equations reducing to quadratics, radical equations, absolute value equations, etc.	0%	8%	64%
Other solution methods for equations (e.g., successive approximation)	0%	0%	18%
Inequalities and their graphical representation	0%	67%	82%
Systems of equations and their solutions (including matrix solutions)	0%	75%	82%
Systems of inequalities	0%	25%	55%
Substituting into or rearranging formulas	67%	67%	73%
General equation of the second degree and its interpretation	0%	8%	45%
Trigonometry and Analytic Geometry	0%	0%	0%
Angle measures: radians and degrees	0%	0%	64%
Law of sines and cosines	0%	0%	64%
Unit circle and trigonometric functions	0%	0%	64%
Parametric equations	0%	0%	18%
Polar coordinates	0%	8%	9%
Polar equations and their graphs	0%	0%	18%
DATA REPRESENTATION, PROBABILITY, & STATISTICS			
Data Representation & Analysis	0%	17%	27%
Collecting data from experiments and simple surveys	92%	83%	55%
Representing data	100%	92%	82%
Interpreting tables, charts, plots, graphs	100%	92%	82%
Kinds of scales (nominal, ordinal, interval, ratio)	17%	8%	9%
Measures of central tendency	67%	92%	64%
Measures of dispersion	25%	58%	82%
Sampling, randomness, and bias related to data samples	0%	58%	55%
Prediction and inferences from data	8%	58%	64%
Fitting lines and curves to data	0%	8%	27%
Correlations and other measures of relations	0%	0%	45%
Use and misuse of statistics	17%	75%	36%
Uncertainty & Probability	0%	0%	9%
Informal likelihoods and the vocabulary of likelihoods	58%	92%	64%

TOPICS	GRADES 1-6 % Economies: 12	GRADES 7-9 % Economies: 12	GRADES 10-12 % Economies: 11
Numerical probability and probability models	42%	92%	82%
Counting principles	25%	42%	73%
Mutually exclusive events	0%	0%	27%
Conditional probability and independent events	0%	8%	45%
Bayes' Theorem	0%	0%	27%
Contingency tables	0%	0%	9%
Probability distributions for discrete random variables	0%	8%	36%
Probability distributions for continuous random variables	0%	8%	36%
Expectation and the algebra of expectations	0%	8%	9%
Sampling (distributions and populations)	0%	17%	45%
Estimation of population parameters	0%	0%	27%
Hypothesis testing	0%	0%	9%
Confidence intervals	0%	0%	27%
Bivariate distributions	0%	0%	9%
Markov processes	0%	0%	9%
Monte Carlo methods and computer simulations	0%	8%	0%
ELEMENTARY ANALYSIS			
Infinite Processes	0%	0%	0%
Arithmetic and geometric sequences	0%	17%	73%
Arithmetic and geometric series	0%	8%	55%
Binomial Theorem	0%	0%	18%
Other sequences and series	0%	0%	27%
Limits and convergence of series	0%	0%	27%
Limits and convergence of functions	0%	0%	18%
Continuity	0%	0%	9%
Change	0%	0%	0%
Growth and decay	0%	0%	9%
Differentiation	0%	0%	18%
Integration	0%	0%	18%
Differential equations	0%	0%	9%
Partial differentiation	0%	0%	0%
VALIDATION & STRUCTURE			
Validation & Justification	0%	33%	0%
Logical connectives	0%	8%	36%
Quantifiers ("for all", "there exists")	0%	8%	9%
Boolean algebra and truth tables	0%	0%	9%
Conditional statements; equivalence of statements (including converse, contrapositive, and inverse)	8%	25%	36%
Inference schemes (e.g., *modus ponens*, *modus tollens*)	0%	0%	18%
Direct deductive proofs	0%	25%	36%
Indirect proofs and proof by contradiction	0%	8%	18%
Proof by mathematical induction	0%	0%	18%

Appendix B
Common Set of Topics
Mathematics

TOPICS	GRADES 1-6 % Economies: 12	GRADES 7-9 % Economies: 12	GRADES 10-12 % Economies: 11
Consistency and independence of axiom systems	0%	0%	18%
Structuring and Abstracting	0%	0%	0%
Sets, set notation, and set combinations	0%	17%	45%
Equivalence relations, partitions, and classes	0%	0%	9%
Groups	0%	0%	0%
Fields	0%	0%	0%
Linear (vectors) spaces	0%	0%	0%
Subgroups, subspaces, etc.	0%	0%	9%
Other axiomatic systems	0%	0%	0%
Isomorphism	0%	0%	0%
Homomorphism	0%	0%	0%
OTHER CONTENT			
Informatics	0%	0%	27%
History and nature of mathematics	8%	17%	36%
Special application of mathematics	0%	0%	36%
Problem solving heuristics	17%	0%	0%
Non-mathematical science content	0%	8%	9%
Non-mathematical content other than science	0%	8%	27%

Appendix B
Common Set of Topics
Mathematics

APPENDIX B (CONTINUED): TOPICS COMMON ACROSS ECONOMIES: SCIENCE GRADES 1-10 & BIOLOGY ORGANIZED BY CODING FRAMEWORK

The set of topics that are common across economies in science consist of the science content included in the coding framework addressed by two-thirds or more of participating economies' standards. The number of economies included in each grade span varies slightly; therefore, the number of economies required for a topic to be included in the set of common topics shifts slightly from span to span. The decision rule for inclusion in the common set of topics is based on a constant percentage: Sixty-seven percent or more of economies included in any given grade span must address the topic in order for the topic to be included in the set of common topics.

The topics included in the set of common topics for each grade span are listed below alongside the percentage of economies addressing that topic in their standards grouped into that grade span. The topics are organized by the categories in the framework (number, measurement, etc.).

TOPICS	GRADES 1-4 % of Economies Addressing Topic 10 Economies	GRADES 5-6 % of Economies Addressing Topic 9 Economies	GRADES 7-10 % of Economies Addressing Topic 10 Economies	BIOLOGY % of Economies Addressing Topic 5 Economies
EARTH SCIENCES				
Earth Features	40%	56%	60%	0%
Earth's composition	20%	11%	60%	0%
Landforms	10%	11%	40%	20%
Bodies of water	40%	33%	50%	0%
Atmosphere	30%	44%	70%	0%
Rocks, soil	50%	44%	60%	0%
Ice forms	0%	11%	20%	0%
Earth Processes	10%	33%	40%	0%
Weather & climate	80%	78%	70%	40%
Physical & Chemical Cycles	30%	67%	70%	20%
Constructive and Destructive Processes	40%	22%	60%	0%
Earth's history	40%	44%	70%	20%
Earth and the Universe	10%	33%	30%	0%
Earth, sun, moon	60%	78%	90%	20%
Planets in the solar system	20%	33%	70%	0%
Beyond the solar system	20%	11%	50%	0%
Evolution of the universe	0%	11%	50%	0%
Motion/location of celestial bodies	40%	33%	50%	0%
LIFE SCIENCES				
Diversity, Organization, Structure of Living Things	60%	67%	90%	80%
Plants	70%	67%	40%	100%
Animals	80%	56%	40%	100%
Other organisms	40%	56%	50%	100%
Systems, organs, tissues	60%	67%	90%	100%

TOPICS	GRADES 1-4 % of Economies Addressing Topic 10 Economies	GRADES 5-6 % of Economies Addressing Topic 9 Economies	GRADES 7-10 % of Economies Addressing Topic 10 Economies	BIOLOGY % of Economies Addressing Topic 5 Economies
Cells	20%	22%	100%	100%
Life Processes and Systems Enabling Life Functions	50%	44%	30%	40%
Energy handling, biochemistry of systems	50%	56%	70%	100%
Sensing and responding	30%	56%	70%	100%
Biochemical processes in cells	0%	22%	60%	100%
Life Spirals, Genetic Continuity, Diversity	10%	11%	10%	20%
Life cycles	70%	67%	90%	100%
Reproduction	40%	33%	80%	100%
Variation and inheritance	30%	11%	80%	100%
Population genetics, biotechnology	0%	0%	50%	80%
Evolution, speciation, diversity	20%	44%	70%	100%
Biochemistry of genetics	0%	0%	70%	100%
Genetic engineering	0%	0%	0%	100%
Interactions of Living Things	20%	44%	40%	40%
Biomes & ecosystems	60%	56%	70%	100%
Habitats & niches	70%	67%	90%	100%
Interdependence of life	60%	33%	70%	80%
Food webs, adaptations to habitats	20%	44%	70%	100%
Competition among organisms	10%	56%	50%	100%
Animal behavior	40%	33%	30%	20%
Needs of living things	60%	78%	90%	100%
Human Biology and Health	80%	89%	80%	80%
Human Nutrition	40%	56%	40%	80%
Human Disease and health	20%	33%	40%	100%
PHYSICAL SCIENCES				
Matter	20%	11%	40%	0%
Classification of matter	90%	78%	90%	0%
Physical properties	100%	67%	100%	0%
Chemical properties	90%	56%	100%	0%
Acids, Bases, Salts	10%	22%	60%	0%
Structure of Matter	10%	11%	40%	0%
Atoms, ions, molecules	10%	11%	80%	0%
Formulas/Equations/Nomenclature Stoichiometry	0%	0%	60%	0%
Macromolecules	10%	11%	20%	0%
Subatomic particles	10%	11%	50%	0%
Energy and Physical Processes	20%	22%	20%	0%
Energy types, conversions, sources	50%	67%	90%	0%
Work, Power, Simple machines	0%	67%	70%	0%
Heat and temperature	90%	89%	80%	0%
Wave phenomena	10%	22%	70%	0%

TOPICS	GRADES 1-4 % of Economies Addressing Topic 10 Economies	GRADES 5-6 % of Economies Addressing Topic 9 Economies	GRADES 7-10 % of Economies Addressing Topic 10 Economies	BIOLOGY % of Economies Addressing Topic 5 Economies
Sound & vibration	50%	33%	70%	0%
Light	80%	56%	80%	0%
Electricity	60%	89%	80%	0%
Magnetism/ electromagnetism	70%	56%	80%	0%
Physical Transformations	20%	0%	30%	0%
Physical changes	70%	78%	80%	0%
Explanations of physical changes	50%	67%	70%	0%
Kinetic-molecular theory	20%	0%	40%	0%
Quantum theory & fundamental particles	0%	0%	0%	0%
Chemical Transformations	20%	0%	40%	0%
Chemical changes	30%	56%	80%	0%
Definition & evidence of chemical change	10%	22%	70%	0%
Types of reactions	10%	44%	70%	0%
Law of Conservation of Matter	0%	44%	30%	0%
Explanations of chemical changes	0%	0%	40%	0%
Determinants/trends of chemical reactivity	0%	0%	10%	0%
Rate of change and equilibria	10%	22%	50%	20%
Energy and chemical change	0%	0%	20%	0%
Calorimetry, exothermic/endothermic reactions	0%	11%	10%	0%
First law of thermodynamics	0%	11%	70%	0%
Second law of thermodynamics	0%	0%	10%	0%
Organic & biochemical changes	0%	11%	20%	20%
Nuclear chemistry	0%	0%	20%	0%
Electrochemistry	20%	11%	40%	0%
Forces and Motion	20%	33%	20%	0%
Types of forces	40%	33%	40%	0%
Contact forces and forces acting at a distance	20%	44%	70%	0%
Pressure - force applied to a surface	10%	11%	40%	0%
Time, space and motion	50%	67%	40%	0%
Measurement of time/space/mass	20%	11%	50%	20%
Types of motion/describing motion	10%	33%	60%	0%
Frames of reference	10%	11%	10%	0%
Dynamics of motion	60%	89%	100%	0%
Relativity theory	0%	0%	0%	0%
Air/fluid behavior	30%	22%	50%	0%
SCIENCE, TECHNOLOGY, & MATHEMATICS				
Nature or Conceptions of Technology	60%	78%	80%	60%
Interactions of Science, Mathematics, & Technology	20%	11%	30%	0%

Appendix B
Common Set of Topics
Science

TOPICS	GRADES 1-4 % of Economies Addressing Topic 10 Economies	GRADES 5-6 % of Economies Addressing Topic 9 Economies	GRADES 7-10 % of Economies Addressing Topic 10 Economies	BIOLOGY % of Economies Addressing Topic 5 Economies
Mathematics, technology influence on science	10%	0%	30%	40%
Science applications in mathematics, technology	40%	44%	70%	40%
Interactions of Science, Technology and Society	30%	44%	50%	20%
Influence of science, technology on society	40%	44%	90%	60%
Influence of society on science, technology	30%	22%	70%	40%
HISTORY OF SCIENCE & TECHNOLOGY				
Environmental and Resource Issues Related to Science	40%	44%	40%	80%
Pollution - Causes and Treatment	40%	67%	80%	80%
Land, Water, Sea Resource Conservation	80%	56%	90%	80%
Material & Energy Resource Conservation	70%	78%	100%	40%
World Population	20%	11%	70%	60%
Food Production, Storage	40%	44%	80%	80%
Effects of Natural Disasters	30%	11%	40%	40%
NATURE OF SCIENCE				
Nature of Scientific Knowledge	60%	56%	90%	80%
The Scientific Enterprise	30%	44%	90%	80%
SCIENCE & OTHER DISCIPLINES				
Science & Mathematics	10%	11%	20%	0%
Science and Other Disciplines	0%	0%	30%	0%

APPENDIX C: ECONOMIES' ORGANIZING STRANDS:
MATHEMATICS
PRIMARY AND UPPER SECONDARY SCHOOLS

The following topics represent the strands, or organizing topics, used by each economy as the organizational framework in their mathematics standards.

Economy	Grade	Strand
Australia	Years 7 and 9	Working mathematically
		Number
		Algebra, function and pattern
		Measurement, chance and data
		Space
Canada	Grade 7	Number
		Patterns and relations
		Shape and space (measurement)
		Shape and space: 2-D and 3-D Objects
		Shape and space: Transformations
		Statistics and probability: data analysis
		Statistics and probability" Chance and uncertainty
	Grade 8	Number
		Patterns and relations: Variables and equations
		Shape and space (measurement)
		Shape and space: 2-D and 3-D shapes
		Shape and space: Transformations
		Statistics and probability: data analysis
		Statistics and probability: Chance and uncertainty
	Grade 9	Number
		Patterns and relations: Variables and equations
		Shape and space (measurement)
		Shape and space: 2-D and 3-D shapes
		Shape and space: Transformations
		Statistics and probability: data analysis
		Statistics and probability: Chance and uncertainty
		Number
		Patterns and relations: Variables and equations
		Shape and space (measurement)
		Shape and space: 2-D and 3-D shapes
		Shape and space: Transformations
		Statistics and probability: data analysis
		Statistics and probability: Chance and uncertainty
China	Grades 7, 8 and 9	Numbers & Algebra
		Space & Figures
		Statistics & Probability

Economy	Grade	Strand
Chinese Taipei	Grade 7	Numbers and Quantity
		Algebra
	Grade 8	Numbers and Quantity
		Algebra
		Geometry
	Grade 9	Geometry
		Algebra
Hong Kong	Key Stage 3	Number and algebra dimensions
		Measures, shape and Space Dimension
		Data handling dimension
Japan	Middle School: Grades 1-3	Numbers and algebraic expressions
		Geometrical figures
		Mathematical relations
Korea	Middle School: First Grade	Numbers and operations
		Variables and Expressions
		Probability and Statistics
		Geometry
	Middle School: Second Grade	Numbers and operations
		Variables and Expressions
		Functions
		Probability and Statistics
		Geometry
	Middle School: Third Grade	Numbers and operations
		Variables and Expressions
		Functions
		Probability and Statistics
		Geometry
Malaysia	Grade 7	Whole Numbers
		Number Patterns and Sequences
		Fractions
		Decimals
		Percentages
		Integers
		Algebraic Expressions
		Basic Measurements
		Lines and angles
		Polygons
		Perimeter and area
		Solid Geometry
	Grade 8	Directed Numbers
		Squares, square roots, cubes and cube roots
		Algebraic expressions 2
		Linear equations
		Ratios, rates and proportions
		Pythagoras' Theorem
		Geometrical constructions
		Coordinates
		Loci in Two Dimensions
		Circles
		Transformations
		Solid Geometry

Appendix C
Strands
Mathematics

Economy	Grade	Strand
Malaysia		Statistics
	Grade 9	Lines and angles II
		Polygons II
		Circles II
		Statistics II
		Indices
		Algebraic Expressions III
		Algebraic Formulae
		Solid Geometry III
		Scale Drawings
		Transformations II
		Linear equations II
		Linear inequalities
		Graphs of functions
		Ratio, rate and proportion II
		Trigonometry
New Zealand	Levels 3, 4, 5 and 6	Number and Algebra
		Geometry and Measurement
		Statistics
Singapore	O-Level Mathematics: Secondary 1, 2, 3 and 4	Numbers and algebra
		Geometry
		Statistics
Thailand	All grades	Numbers and operations
		Measurement
		Geometry
		Algebra
		Data analysis and probability
		Mathematical skills and processes
		Numbers and operations
		Measurement
United States	Grade 8	Number properties and operations
		Measurement
		Geometry
		Data analysis and probability
		Algebra

APPENDIX C (CONTINUED): ECONOMIES' ORGANIZING STRANDS:
MATHEMATICS
UPPER SECONDARY

The following topics represent the strands, or organizing topics, used by each economy as the organizational framework in their mathematics standards.

Economy	Grade	Strands	Sub strands
China	10-12	Numbers & Algebra	Knowing Numbers Number Operations Common Quantities (1-3) Expressions and Equations (4-6) Exploring Patterns (1-6) Equations and Inequalities (7-9) Functions (7-9)
		Space & Figures	Knowing Figures Measurements (1-6) Figures and their Transformation Figures and their Positions (1-6) Figures and their Coordinates (7-9) Figures and Proofs (7-9)
		Statistics & Probability	Statistical Data Activities for Beginners (1-3) Phenomenon of Uncertainty (1-3) Simple Statistical Data Processing (4-6) Possibility (4-6) Statistics (7-9) Probability (7-9)
		Practical and Integrated Applications	
Chinese Taipei	Senior High (2 years)	Numbers and Coordinate Systems	Integers
			Rational Numbers and real numbers
			Plane coordinate system
			Complex numbers and planar complex numbers
		Number Lines and Progression	Arithmetical series and geometric progressions
			Infinite geometric progressions and recurring decimals
			Finite induction
		Polynomials	The arithmetic of polynomials
			Remainder theorem and factor theorem
			Highest common factor and lowest common multiple
			Polynomial functions
			Polynomial equations
			Polynomial inequalities
		Attachment	Recognize proofs

Economy	Grade	Strands	Sub strands
Chinese Taipei		Exponent and Logarithm	Exponents
			Exponent functions and figures
			Logarithms
			Logarithm functions and figures
			Checking tables and interpolation method
		Basic concept of trigonometric functions	Acute trigonometric functions
			Basic relationship of trigonometric functions
			Simple measurements and trigonometric function tables
			Trigonometric function of generalized diagonals
			Law of sines and cosines.
			Basic measurements of a triangle
		Characters and application of trigonometric functions	Figures of trigonometric functions*
			Sum and Difference Formulas
			Double angle formula* and half-angle formula
			Congruence of sinusoidal function
			Polar form (of complex numbers)
		Attachment	Concept of functions
			Figures of cotangent function, secant function and cosecant function
		Vector	Directed line segments and vectors
			Basic application of vectors
			The presentation of plane vectors on the coordinate grid
			Inner product of plane vectors
		Straight line and plane of space	Space concept
			Space coordinate system
			The presentation of Space vectors on coordinates
			Plane equations
			Space rectilinear equation
			Linear equation groups
		Circle and sphere equation	Circle equation
			The relationship between circles and straight lines
			Sphere equation
			The relationship of spheres and planes
		Conic Section	The origin of the name of conic section
			Parabola (Standard)
			Ellipse (Standard)
			Hyperbola (Standard)
			Light characteristics of conic section
		Permutation and	Counting combined elements

Economy	Grade	Strands	Sub strands
Chinese Taipei		Combination	Addition and multiplication
			Permutation
			Combination
			Binomial theorem
			Recurrence relationships
		Probability and Statistics	Events and combination
			Characteristics of probability
			Mathematical expectations
			Sources of statistic data
			Analyze one-dimensional data
			Recognition of confidence interval and confidence level
Hong Kong	Key Stage 4	Number and algebra dimensions	More about Polynomials
			Arithmetic and Geometric Sequences and their Summation
			Quadratic Equations in One Unknown
			More about Equations
			Variations
			Linear Inequalities in Two Unknowns
			Exponential and Logarithmic Functions
			Functions and Graphs
		Geometry	Qualitative Treatment of Locus
			Basic Properties of Circles
			Coordinate Treatment of Simple Locus Problems
			More about Trigonometry
		Data handling dimensions	Measures of Dispersion
			Uses and Abuses of Statistics
			Conducting Surveys
			More about Probability
			Further apply mathematics in various dimensions to more sophisticated real-life or mathematical situations
Korea	High School: First Grade	Numbers and Operations	Operations of Sets
			Propositions
			Real Number
Malaysia	Grade 10	Standard Form	Understand and use the concept of significant figures.

Economy	Grade	Strands	Sub strands
Malaysia			Understand and use the concept of standard form to solve problems
		Quadratic Expressions and Equations	Understand the concept of quadratic expression
			Factorize quadratic expressions
			Understand the concept of quadratic equations.
			Understand and use the concept of roots of quadratic equations to solve problems
		Sets	Understand the concept of set
			Understand and use the concept of subset, universal set and the complement of a set.
			Perform operations on the intersection of sets and the union of sets.
		Mathematical Reasoning	Understand the concept of statement
			Understand the concept of quantifiers "all" and "some."
			Perform operations involving the words "not" or "no," "and" and "or" on statements.
			Understand the concept of implications.
			Understand the concept of argument.
			Understand and use the concept of induction and deduction to solve problems.
		The Straight Line	Understand the concept of a gradient of a straight line
			Understand the concept of a gradient of a straight line in Cartesian coordinates.
			Understand the concept of intercept
			Understand and use equation of a straight line
			Understand and use the concept of parallel lines.
		Statistics	Understand the concept of class interval
			Understand and use the concept of mode and mean of grouped data.
			Represent and interpret data in histograms with class intervals of the same size to solve problems.
			Represent and interpret data in frequency polygons to solve problems
			Understand the concept of cumulative frequency
			Understand and use the concept of measures of dispersion to solve problems.
		Probability I	Understand the concept of sample space
			Understand the concept of events

Economy	Grade	Strands	Sub strands
Malaysia			Understand and use the concept of probability of an event to solve problems
		Circles III	Understand and use the concept of tangents to a circle
			Understand and use the properties of angle between tangent and chord to solve problems
			Understand and use the properties of common tangents to solve problems
		Lines and Planes in 3 dimensions	Understand and use the concept of angle between lines and planes to solve problems
			Understand and use the concept of angle between two planes to solve problems
	Grade 11	Number Bases	Understand and use the concept of number in base two, eight and five
		Graphs of Functions II	Understand and use the concept of graphs of functions
			Understand and use the concept of the solution of an equation by graphical method
			Understand and use the concept of the region representing inequalities in two variables
		Transformations III	Understand and use the concept of combination of two transformations
		Matrices	Understand and use the concept of matrix
			Understand and use the concept of equal matrices
			Perform addition and subtraction on matrices
			Perform multiplication of a matrix by number
			Perform multiplication of two matrices
			Understand and use the concept of identity matrix
			Understand and use the concept of inverse matrix
			Solve simultaneous linear equations by using matrices
		Variations	Understand and use the concept of direct variation
			Understand and use the concept of inverse variation
			Understand and use the concept of joint variation
		Gradient and Area under a graph	Understand and use the concept of quantity represented by the gradient of a graph
			Understand the concept of quantity represented by the area under a graph

Economy	Grade	Strands	Sub strands
Malaysia		Probability II	Understand and use the concept of probability of an event
			Understand and use the concept of probability of the complement of an event
			Understand and use the concept of probability of combined event
		Bearing	Understand and use the concept of bearing
		Earth as a sphere	Understand and use the concept of latitude
			Understand and use the concept of longitude
			Understand the concept of location of a place
			Understand and use the concept of distance on the surface of the earth to solve problems
		Plans and Elevations	Understand and use the concept of orthogonal projection
			Understand and use the concept of plan and elevation
New Zealand	Level Five	Number and Algebra	Number strategies and knowledge
			Equations and expressions
			Patterns and relationships
		Geometry and Measurement	Measurement
			Shape
			Positions and orientation
			Transformation
		Statistics	Statistical investigation (thinking
			Statistical literacy
			Probability
	Level Six	Number and Algebra	Number strategies and knowledge
			Equations and expressions
			Patterns and relationships
		Geometry and Measurement	Measurement
			Shape
			Positions and orientation
			Transformation
		Statistics	Statistical investigation (thinking
			Statistical literacy
			Probability
	Level Seven	Number and Algebra	Number strategies and knowledge
			Equations and expressions
			Patterns and relationships
		Geometry and Measurement	Measurement
			Shape
			Positions and orientation
			Transformation
		Statistics	Statistical investigation (thinking

Economy	Grade	Strands	Sub strands
New Zealand			Statistical literacy
			Probability
		Mathematics	Patterns and relationships
			Equations and expressions
			Calculus
	Level Eight	Number and Algebra	Number strategies and knowledge
			Equations and expressions
			Patterns and relationships
		Geometry and Measurement	Measurement
			Shape
			Positions and orientation
			Transformation
		Statistics	Statistical investigation (thinking
			Statistical literacy
			Probability
		Mathematics	Patterns and relationships
			Equations and expressions
			Calculus
Singapore	A Level Mathematics (H2)	Pure Mathematics	Functions and Graphs
			Sequences and Series
			Vectors
			Complex numbers
			Calculus
		Statistics	Permutations, combinations and probability
			Binomial, poisson, and normal distributions
			Sampling and hypothesis testing
			Correlation and regression
Thailand	All Grades	Numbers and operations	
		Measurement	
		Geometry	
		Algebra	
		Data analysis and probability	
		Mathematical skills and processes	

APPENDIX C (CONTINUED): ECONOMIES' ORGANIZING STRANDS: SCIENCE
LOWER SECONDARY SCHOOL

The following topics represent the strands, or organizing topics, used by each economy as the organizational framework in their science standards.

Economy	Grade Level	Strands	Sub-Strands
Australia	Years 7 and 9	Science as a human Endeavour	
		Science as a way to know	
		Science as a body of knowledge	Energy and force
			Matter
			Living things
			Earth and space
Canada	Grades 1-3	STSE (Science, technology, society and environment)	Nature of science and technology
			Relationships between science and technology
			Social and environmental contexts of science and technology
		Skills	Initiating and planning
			Performing and recording
			Analyzing and interpreting
			Communication and teamwork
		Attitudes	Appreciation of science
			Interest in science
			Scientific inquiry
			Collaboration
			Stewardship
			Safety in science
		Knowledge	Life science
			Physical science
			Earth and space science
	Grade 1	STSE & Skills subsumed under the Knowledge Topics:	LIFE SCIENCE /Properties of objects and materials
			PHYSICAL SCIENCE / Properties of objects and materials
			PHYSICAL SCIENCE / Materials and our senses
			EARTH AND SPACE SCIENCE / Daily and seasonal changes
	Grade 2	STSE & Skills subsumed under the Knowledge Topics:	Life Science / Animal growth and changes
			Physical Science / Liquids and solids
			Physical Science / Relative position and motion
			Earth & Space Science / Air and water in the environment
	Grade 3	STSE & Skills subsumed under the	Life Science / Plant growth and changes
			Physical Science / Materials and structures

Economy	Grade Level	Strands	Sub-Strands
Canada		Knowledge Topics:	Physical Science / Invisible forces
			Earth & Space Science / Exploring soils
	Grades 4-6	STSE (Science, technology, society and environment)	Nature of science and technology
			Relationships between science and technology
			Social and environmental contexts of science and technology
		Skills	Initiating and planning
			Performing and recording
			Analyzing and interpreting
			Communication and teamwork
		Knowledge	Life science
			Physical science
			Earth and space science
		Attitudes	Appreciation of science
			Interest in science
			Scientific inquiry
			Collaboration
			Stewardship
			Safety in science
	Grade 4	STSE & Skills subsumed under the Knowledge Topics:	Life Science / Habitats and communities
			Physical Science / Light
			Physical Science / Sound
			Earth & Space Science / Rocks, minerals, and erosion
	Grade 5	STSE & Skills subsumed under the Knowledge Topics:	Life Science / Meeting basic needs and maintaining a healthy body
			Physical Science / Properties and changes of materials
			Physical Science / Forces and simple machines
			Earth & Space Science /Weather
	Grade 6	STSE & Skills subsumed under the Knowledge Topics:	Life Science / Diversity of Life
			Physical Science / Electricity
			Physical Science / Flight
			Earth & Space Science / Space
	Grades 7-9	STSE (Science, technology, society and environment)	Nature of science and technology
			Relationships between science and technology
			Social and environmental contexts of science and technology
		Skills	Initiating and planning
			Performing and recording
			Analyzing and interpreting
			Communication and teamwork
		Knowledge	Life science
			Physical science
			Earth and space science
		Attitudes	Appreciation of science

Economy	Grade Level	Strands	Sub-Strands
Canada			Interest in science
			Scientific inquiry
			Collaboration
			Stewardship
			Safety in science
	Grade 7	STSE & Skills subsumed under the Knowledge Topics:	LIFE SCIENCE / Interactions within ecosystems
			PHYSICAL SCIENCE / Mixtures and solutions
			PHYSICAL SCIENCE / Heat
			EARTH AND SPACE SCIENCE / Earth's crust
	Grade 8	STSE & Skills subsumed under the Knowledge Topics:	Life Science / Cells, tissues, organs, and systems
			Physical Science / Optics
			Physical Science / Fluids
			Earth & Space Science / Water systems on Earth
	Grade 9	STSE & Skills subsumed under the Knowledge Topics:	Life Science / Reproduction
			Physical Science / Atoms and elements
			Physical Science / Characteristics of electricity
			Earth & Space Science / Space exploration
	Grade 10	STSE & Skills subsumed under the Knowledge Topics:	Life Science / Sustainability of Ecosystems
			Physical Science / Chemical Reactions
			Physical Science / Motion
			Earth & Space Science / Weather Dynamics
Chinese Taipei	Stage Four (Grades 7-9)	Recognition levels	
		Recognition of the Physiology of plants and animals	
		Recognition of environment	
		Recognition of substances	
		Recognition of reactions	
		Viewpoints of energy	
		Recognition of common technology	
Japan	First Field (Grade 7)	Familiar physical phenomena	Light and sound
			Force and pressure
		Familiar substances	The characteristics of substances
			Water solution
		Electric current and its uses	Electric Current
			The uses of electric current
		Chemical change, and atoms / molecules	Formation of substances
			Chemical change and the mass of substances
		The regularity of motion	

Economy	Grade Level	Strands	Sub-Strands
Japan		The uses of substances and chemical reactions	
		Science-technology and human beings	Energy resources
			Science-technology and human beings
	Second Field (Grade 8)	Life and kinds of plants	Observation of living things
			Body structure and function of plants
			Families of plants
		Changes of the earth	Strata and the state of the earth in the past
			Volcanoes and earthquakes
		Life and kinds of animals	Body structure and function of animals
			Families of animals
		The weather and its changes	Observation of the weather
			Changes of the weather
		Cells and reproduction in living things	Living things and cells
			Reproduction of living things
		The earth and space	The movement of celestial bodies and the rotation and revolution of the earth
			The solar system and the planets
		Nature and human beings	Nature and the environment
			Nature and human beings
	Integrated Science A *(aka General Science A)*	Investigation of nature	Scientific view of nature
			Method of doing investigation
		Human life resources and energy	The development and utilization of resources
			Various energy
		Matter and human life	Composition and change of matter
			Utilization of matter
		Human life and the progress of science and technology	
Korea	First Grade	Motion and Energy	Height
			Distance
		Material	Putting things in order
			Learning how to use tools
		Life	Learning about safety
			Playing hospital
	Second Grade	Motion and Energy	Time
			Weight
		Material	Picture maps
			Collecting fruits and seeds
			Collecting materials
		Life	Animal and plant growth
			Observation of changes over the course of time
		Earth and Space	shadows
	Third Grade	Motion and Energy	Properties of magnets
			Light traveling in a straight line

Appendix C
Strands
Science

Economy	Grade Level	Strands	Sub-Strands
Korea		Material	Object and materials
			Liquid and gases
			Separation of mixtures
		Life	Life cycle of animals
			Animal's world
		Earth and Space	Weather and our life
	Fourth Grade	Motion and Energy	Weight
			Heat transfer
		Material	Phase change of water
		Life	Life cycle of plants
			Plant's world
		Earth and Space	Geological strata and fossils
			Volcanoes and earthquakes
			Change in the earth surface
	Fifth Grade	Motion and Energy	Speed of an object
			Electric Circuit
		Material	Dissolution and solution
		Life	Plant structures and functions
			World of micro-organism
			Human body
		Earth and Space	Earth and the moon
			Solar system and stars
	Sixth Grade	Motion and Energy	Light
			Energy
			Magnetic Fields
		Material	Acids and bases
			Various gases
			Combustion and extinguishment
		Life	Ecosystems and environments
		Earth and Space	Weather changes
			Seasonal changes
	Seventh Grade	Motion and Energy	Force and motion
			Electrostatics
		Material	Three Phases of matter
			Molecular motion
			Phase change and energy
		Life	Organization and diversity of living organisms
			Plant nutrition
		Earth and Space	Earth's crust materials and changes
			Tectonic movements and Plate tectonics
	Eighth Grade	Motion and Energy	Thermal Energy
			Light and waves
		Material	Composition of substances
			Compounds around us
		Life	Digestion and circulation

Economy	Grade Level	Strands	Sub-Strands
Korea			Respiration and excretion
		Earth and Space	Solar system
			Stars and the Universe
	Ninth Grade	Motion and Energy	Work and energy
			Electricity
		Material	Nature of matter
			Electrolytes and ions
		Life	Stimulus and response
			Reproduction and development
		Earth and Space	Characteristics of atmosphere and weather change
			Composition and movement of sea water
	Tenth Grade	Motion and Energy	Motion of an object
			Electromagnetism
		Material	Regularity in chemical reaction
			Various chemical reactions
		Life	Inheritance and evolution
			Life science and the future of human species
			Energy in nature
		Earth and Space	Earth system
			Movement of celestial bodies
Hong Kong	Grades 1-3	Scientific Investigation	
		Life and Living	
		The Material World	
		Energy and Change	
		The Earth and Beyond	
		Science, Technology and Society	
	Grades 4-6	Scientific Investigation	
		Life and Living	
		The Material World	
		Energy and Change	
		The Earth and Beyond	
		Science, Technology and Society	
	Grades 7-9	Scientific Investigation	
		Life and Living	
		The Material World	
		Energy and Change	
		The Earth and Beyond	
		Science, Technology and Society	
	Grade 10	Scientific Investigation	

Economy	Grade Level	Strands	Sub-Strands
Hong Kong		Life and Living	
		The Material World	
		Energy and Change	
		The Earth and Beyond	
		Science, Technology and Society	
Malaysia	Year 1	Learning about living things	Ourselves
			Animals
			Plants
		Learning about the world around us	Using our senses
			Finding out about things that float and sink
			Finding out about light and dark
	Year 2	Learning about living things	Living things and non-living things
			Ourselves
			Animals
			Plants
		Learning about the world around us	Long or short
			The magic batteries
			Mixing things
			Push and pull
	Year 3	Learning about living things	Animals
			Plants
		Learning about the world around us	Magnets
			Electricity
			Springs
			Absorption
			Soil
			Mixing substances
	Year 4	Learning about living things	Living things have basic needs
			Living things undergo life processes
			Animals and plants protect themselves
		Investigating the Earth and the Universe	The solar system
		Investigating materials	Properties of materials
		Investigating force and energy	Measurement
		Investigating technology	Technology
	Year 5	Learning about living things	Microorganism
			Survival of the species
			Food chain and food web
		Investigating force and energy	Energy
			Electricity
			Light

Economy	Grade Level	Strands	Sub-Strands
Malaysia			Heat
		Investigating materials	States of matter
			Acid and alkali
		Investigating the Earth and the Universe	Constellation
			The earth, the moon and the sun
		Investigating technology	Strength and stability
	Year 6	Investigating living things	Interaction among living things
		Investigating force and energy	Force
			Movement
		Investigating materials	Food preservation
			Waste management
		Investigating the Earth and the Universe	Eclipses
		Investigating technology	Machine
	Form 1 (Grade 7)	Introduction to science	
		Man and the variety of living things	Cell as a unit of life
		Matter in nature	Matter
			The variety of resources on earth
			The air around us
		Energy	Sources of energy
			Heat
	Form 2 (Grade 8)	Management and continuity of life	The world through our senses
			Nutrition
		Man and the variety of living things	Biodiversity
			Interdependence among living organisms and the environment
		Matter in nature	Water and solution
			Air pressure
		Force and Motion	Dynamics
			Support and movement
		Technological and industrial development in society	Stability
			Simple machine
	Form 3 (Grade 9)	Management and continuity of life	Respiration
			Blood circulation and transport
			Excretion
			Reproduction
			Growth
		Matter in nature	Land and its resources

Economy	Grade Level	Strands	Sub-Strands
Malaysia		Energy in life	Electricity
			Generation of electricity
		Astronomy and space exploration	Stars and galaxies
			Space exploration
	Form 4 (Grade 10)	Introducing science	Scientific investigation
		Maintenance and continuity of life	Body coordination
			Heredity and variation
		Matter in nature	Matter and substance
		Energy in life	Energy and chemical changes
			Nuclear energy
			Light, color, and sight
		Technological and industrial development in society	Chemicals in industry
New Zealand	Level 1 and 2	Nature of science	Understanding about science
			Investigating in science
			Communicating in science
			Participating and contributing
		Living world	Life processes
			Ecology
			Evolution
		Planet Earth and beyond	Earth systems
			Interacting systems
			Astronomical systems
		Physical world	Physical inquiry and physics concepts
		Material world	Properties and changes of matter
			Structure of matter
			Chemistry and society
	Level 3	Nature of science	Understanding about science
			Investigating in science
			Communicating in science
			Participating and contributing
		Living world	Life processes
			Ecology
			Evolution
		Planet Earth and beyond	Earth systems
			Interacting systems
			Astronomical systems
		Physical world	Physical inquiry and physics concepts
		Material world	Properties and changes of matter
			Structure of matter
			Chemistry and society
	Level 4	Nature of science	Understanding about science
			Investigating in science
			Communicating in science

Economy	Grade Level	Strands	Sub-Strands
New Zealand			Participating and contributing
		Living world	Life processes
			Ecology
			Evolution
		Planet Earth and beyond	Earth systems
			Interacting systems
			Astronomical systems
		Physical world	Physical inquiry and physics concepts
		Material world	Properties and changes of matter
			Structure of matter
			Chemistry and society
	Level 5	Nature of science	Understanding about science
			Investigating in science
			Communicating in science
			Participating and contributing
		Living world	Life processes
			Ecology
			Evolution
		Planet Earth and beyond	Earth systems
			Interacting systems
			Astronomical systems
		Physical world	Physical inquiry and physics concepts
		Material world	Properties and changes of matter
			Structure of matter
			Chemistry and society
	Level 6	Nature of science	Understanding about science
			Investigating in science
			Communicating in science
			Participating and contributing
		Living world	Life processes
			Ecology
			Evolution
		Planet Earth and beyond	Earth systems
			Interacting systems
			Astronomical systems
		Physical world	Physical inquiry and physics concepts
		Material world	Properties and changes of matter
			Structure of matter
			Chemistry and society
Singapore	Primary 3 and 4	Diversity	Diversity of living and non-living things
			Diversity of materials
		Cycle	Cycles in plants and animals
			Cycles of matter and water
		Systems	Plant system
			Human system

Economy	Grade Level	Strands	Sub-Strands
Singapore		Energy	Energy forms and uses
		Interactions	Interactions and forces
	Primary 5 and 6	Diversity	
		Cycle	Cycles in plants and animals
			Cycles of matter and water
		Systems	Plant system
			Human system
			Electrical system
			Cell system
		Energy	Energy conversion
			Energy forms and uses
		Interactions	Interaction and forces
			Interaction within the environment
	Express/ Normal - Academic: Lower Secondary (Grades 7-10)	Knowledge, understanding and application	Diversity
			Cycle
			Systems
			Energy
			Interactions
United States	National Assessment of Educational Progress: Grade 4	Earth Science	Solid earth
			Water
			Air
			Earth in space
		Physical Science	Matter and its transformations
			Energy and its transformations
			Motion
		Life Science	Change and evolution
			Cells and their functions
			Organisms
			Ecology
	National Assessment of Educational Progress: Grade 8	Earth Science	Solid earth
			Water
			Air
			Earth in space
		Physical Science	Matter and its transformations
			Energy and its transformations
			Motion
		Life Science	Change and evolution
			Cells and their functions
			Organisms
			Ecology

APPENDIX C (CONTINUED): ECONOMIES' ORGANIZING STRANDS: SCIENCE
UPPER SECONDARY COURSES (GRADES 10-12)

The following topics represent the strands, or organizing topics, used by each economy as the organizational framework in their science standards.

Economy	Courses	Strands	Sub-Strands
Canada	Life Science Objectives	STSE & Skills subsumed under the Knowledge Topics	Reproduction and Development
			Matter and Energy For Life
			Genetic Continuity
			Evolution, Change, and Diversity
			Maintaining Dynamic Equilibrium
			Interactions among Living Things
	Physics Objectives	STSE & Skills subsumed under the Knowledge Topics	Force, Motion, and Work
			Energy and Momentum
			Waves
			Fields
			Radioactivity and Modern Physics
	Earth & Space Science Objectives	STSE & Skills subsumed under the Knowledge Topics	Earth Systems
			Earth Resources
			Historical Geology
			Astronomy
	Chemistry objectives	STSE & Skills subsumed under the Knowledge Topics	Organic Chemistry
			Acids and Bases
			From Structures to Properties
			Electrochemistry
			Solutions and Stoichiometry
			Thermochemistry
Chinese Taipei	Basic Biology	Characteristics of life	Phenomena of life
			Cell chemical composition
			Cell structure
			Cell division
		Biodiversity	Meaning of biodiversity
			Bioclassification
			Virus and bacteria
			Fungi and algae
			Plant
			Animal
		Organisms and Environment	Individual and population
			Community Ecosystem
			Terrestrial ecosystem
			Aquatic ecosystem
		Human Beings and Environment	Development and use of resources
			Impact of human kind on ecosystems

Economy	Courses	Strands	Sub-Strands
Chinese Taipei	Biology		Conservation and sustainable development of nature
		Cell and organisms	Cell
			Tissues, organs and systems
		Nutrition in plants	Structures of roots, stems and leaves
			Absorption and transportation of water and inorganic salts
			Photosynthesis and respiration
			Transportation of nutrients
		Reproduction, growth and development of plants	Reproduction of plants
			Seed germination and growth
			Substances regulating the development and growth of plants
			Plant reaction of environmental stimulation
		Metabolism and homeostasis of animals	Digestion and nutrition
			Nutrient circulation and transport
			Breathing and exchange of gases
			Excretion and fluid balance
		Coordination of animals	immunity
			Nerves and movements
			Hormones and coordination
			Animal Behaviors
		Animal reproduction and genetics	Animal reproduction
			Human reproduction and embryogeny
			Genes and heredity
			Human genetics
		Science and human life	Gene Expression
			Biotechnology and other applications
			Impacts of biotechnology
	Basic Physics	Overview	Importance of physics and its relationship with other scientific subjects
			Measurement and units
		Motion and force	Common types of motion in everyday life
			Common types of force in every day life
			Force and motion
		Heat	Temperature and heat
			Heat and change of state
			Heat and life
		Sounds	Generation of sounds and its traveling
			Sound deflection
			Musical notes and instruments
			noise
		Light	Human perception of light
			Transmission of light
			Refraction and reflection of light
			Light and our daily life

Economy	Courses	Strands	Sub-Strands
Chinese Taipei		Electricity and Magnetism	Understanding of electricity
			Direct and alternating current
			Magnets and terrestrial magnetism
			The heat and magnetic forces of electric current
			Transformers and the flow of change
			Family electricity use and safety
		Energy and life	Various forms of energy and energy conversion
			Nuclear and replacement energy
			Energy efficiency and power saving
		Modern Technology	Brief introduction to modern technology
		Modern Physics	Brief introduction to modern physics
		Attachment 1. Brief introduction to cosmology	Observation of planets and Hubble's law
			Cosmological theories about the origin of the universe
			evolution of planets
		Attachment 2. Brief history of physics	Brief history of development of physics
	Physics	Statics	Transitional equilibrium
			Torque and rotational equilibrium
			Static equilibrium
			Centre of gravity and centre of mass
		Kinematics	Rectilinear motion
			two-dimensional motions
		Newton's laws	Inertia and Newton's first law
			Newton's second law
			Newton's third law
			Friction
		Momentum and the application of Newton's laws	Momentum and impulse
			Conservation of momentum
			The motion of the center of mass
			Uniform circular motion
			Simple harmonic motions
			Dimensions in physical situation
		Rotation	Rotation around a fixed axis
			Angular momentum and moment of inertia
			Angular momentum as a conserved quantity
		Gravitation	Kepler's laws of planetary motion
			The law of universal gravitation
			Gravitational field and acceleration
			Satellites
		Work and energy	Work and power
			Definition of kinetic energy and mechanical energy
			potential energy
			Conservation of mechanical energy
		Collisions	Elastic collisions

Economy	Courses	Strands	Sub-Strands
Chinese Taipei			Inelastic collisions
		Properties of fluids	Pressure and buoyant force of fluids at rest
			Pascal's principle and its applications
			Atmospheric pressure
			Surface tension and capillary action of fluids
			Bernoulli equation and its applications
		Heat	Thermal capacity and specific heat
			Change of state of a material and latent heat
			Thermal expansion
			Ideal gas equation
			Kinetic Theory of gas
	Basic Chemistry	Overview	Chemistry
			Chemistry and life
		Substances of the natural world	Natural world
			Water
			Atmosphere
			Soil
		Formation and changes of substances	Formation of substances
			Mass of substances
			Features of substances
			Changes of substances
		The power in our life	Introduction to power
			Fossil power and burning heat
			Chemical batteries
			Other power
		The substances in our daily lives	Food and chemistry
			Clothing material and chemistry
			Materials and chemistry
			Medicine and chemistry
	Chemistry	Structure of substances	Structure of atoms
			Element and periods
			Formation of substances
			The structure of hydrocarbons
		State of Substances	Changing states of substances
			Properties of gas
			Nature of solutions
		Changes of substances	Chemical reactions
			Chemical reaction rate
			Acids and Bases
			Oxidation and reduction
			Additions and substitutions
		Properties of substance	Properties of nonmetal elements
			Properties of metal elements
	Basic Earth Science	Humans and global environment	Explore the origin of earth
			A general overview of human and global

Economy	Courses	Strands	Sub-Strands
Chinese Taipei			environment
		The earth in space	View the earth from space
			View the sky from earth
		Active earth	Structure of the earth
			Atmosphere and transformation of oceans
			Transformation of solid earth
		Natural disasters	Water disasters
			Geologic disasters
		The transformation of global environment	The change of climate
			The change of coast
		Global resources and future development	Resources, environment and future development
	Earth Science	The earth in ancient and modern times	Explore the origin, shape and size of the earth
			Explore the origin of time
		Exploration of the global environment	Observe the winds and clouds
			Predict the phenomena of the oceans
			Explore the stratum
			Watch the sky
			Observational skills for the global environment in modern times
		Global environment and its characteristics	Gorgeous mountains and rivers
			Deep oceans
			Varied weather
			Bright sky
		Daily lives and global environment	Minerals, energy and daily life
			Beautiful stones
			Water resources and daily life
			Watch the weather when going out
			Chose the land to build houses
			Travel and global environment
		Interaction of human being and the global environment	Biology, human being and the global environment
			Face the global change on earth
Japan	Biology I	Continuity of life	Cells
			Reproduction and development
			Heredity
			Investigation activities concerned with the continuity of life
		Reactions between living things and the environment	Reactions of animals to the environment
			Reactions of plants to the environment
			Research projects concerned with reactions of living things to the environment
	Biology II	Biological phenomena and substances	The functions of proteins and biological organisms
			Genetic information and its manifestation
		Biological	The classification and phylogeny of living things

98

Economy	Courses	Strands	Sub-Strands
Japan		classification and evolution	The evolution of living things
		Groups of living things	Structure and maintenance of populations
			Biocenoses and ecosystems
		Research project	
	Chemistry I	Composition of substances	Substances and human life
			Constituent particles of substances
			Investigation activities concerning the composition of substances
		Kinds and properties of substances	Inorganic substances
			Organic compounds
			Investigation activities with kinds and properties of substances
		Changes in substances	Chemical reactions
			Investigation activities concerned with changes in substances
	Chemistry II	Structure of substances and chemical equilibrium	Structure of substances
			Chemical equilibrium
		Substances and daily life	Chemistry of food and clothing
			Chemistry of materials
		Substances and living things	Chemistry of life
			Chemistry of medical supplies
		Research project	Research on specific chemical phenomena
			Research on some experiments that develop chemistry further
	Earth Science I	The composition of the earth	Overview of the earth
			Interior of the earth
			History of the earth
			Research project concerned with the composition of the earth
		Composition of the atmosphere, the oceans and the universe	Atmosphere and the oceans
			Composition of the universe
			Research project concerned with the composition of the atmosphere, the oceans and the universe
	Earth Science II	Investigation of the earth	Movement of plates and changes in the earth's mantle
			Passage of time in the Japanese archipelago
		Investigation of the earth's crust	Observation of the earth
			Phenomena in the atmosphere and the oceans
		Investigation of the universe	Observation of heavenly bodies
			Spatial extent of the universe
		Research project	
	Physics I	Electricity	Electricity in daily life
			Exploratory activities concerned with electricity
		Waves	Different kinds of waves

Economy	Courses	Strands	Sub-Strands
Japan			Sound and light
			Exploratory activities concerned with waves
		Motion and energy	Motion of objects
			Energy
			Exploratory activities concerned with motion and energy
	Physics II	Force and motion	Motion of objects
			Circular motion and universal gravitation
		Electricity and magnetism	Electric fields and magnetic fields
			Electromagnetic induction and electromagnetic waves
		Matter and atoms	Motion of atoms and molecules
			Atoms, electrons and the properties of matter
		Atoms and atomic nuclei	Structure of an atom
			Atomic nucleus and elementary particles
		Topic-based research	Research into specified physical phenomena
			Research into experiments designed to let physics advance further
Korea	Physics	Power and Energy	Velocity and accelerated velocity
			Laws of motion
			Momentum and impulse
			Work and power
			Conservation of mechanical energy
			Conservation of energy
		Electricity and magnetism	Voltage and electric current
			Electric resistance
			Heat effect on electron current
			Galvono- magnetic effect
			Electromagnetic induction
		Wave and Particle	Generation of wave and propagation
			Reflection and refraction of wave
			Interference and diffraction of wave
			Polarized light
			Photoelectric effect
			Material wave
Hong Kong	Biology S4-S6	Cells and Molecules of Life	Molecules of life
			Cellular organization
			Movement of substances across membrane
			Cell cycle and division
			Cellular energetic
			Respiration
		Genetics and Evolution	Basic genetics
			Molecular genetics
			Biodiversity and evolution
		Organisms and	Essential life processes in plants

Economy	Courses	Strands	Sub-Strands
Hong Kong		Environment	Essential life processes in animals
			Reproduction, growth and development
			Coordination and response
			Homeostasis
			Ecosystems
		Health and Disease	Personal health
			Diseases
			Body defense mechanisms
		Human Physiology: Regulation and Control (Elective)	Regulation of water content
			Regulation of body temperature
			Regulation of gas content in blood
			Hormonal control of reproductive cycle
		Applied Ecology (Elective)	Human impact on the environment
			Pollution control
			Conservation
			Sustainable development
		Microorganisms and Humans (Elective)	Microbiology
			Use of microorganisms
			Microbial genetics
			Harmful effects of microorganisms
		Biotechnology (Elective)	Introduction to biotechnology
			Techniques in modern biotechnology
			Biotechnology in medicine
			Biotechnology in agriculture
			Transgenic plants
			Bioethics
	Chemistry S4-S6	Topic I Planet Earth	The atmosphere
			The ocean
			Rocks and minerals
		Microscopic World I	elements, atoms and symbols
			The Periodic Table
			Metallic bonding
			Structures and properties of metals
			Ionic and covalent bond
			Structures and properties of giant ionic substances
			Structures and properties of simple molecular substances
			Structures and properties of giant covalent substances
			Comparison of structures and properties of important types of substances
		Metals	Occurrence and extraction of metals
			Reactivity of metals
			Corrosion of metals and their protection
		Acids and Bases	Indicators and pH

Economy	Courses	Strands	Sub-Strands
Hong Kong			Strength of acids and alkalis
			Salts and neutralization
			Concentration of solutions
			Volumetric analysis involving acids and alkalis
		Fossil Fuels and Carbon Compounds	Homologous series, structural formulae and naming of carbon compounds
			Alkanes and alkenes
			Addition polymers
		Microscopic World II	Bond polarity
			Intermolecular forces
			Structures and properties of molecular crystals
			Simple molecular substances with non- octet structures
			Shapes of simple molecules
		Redox Reactions, Chemical Cells and Electrolysis	Chemical cells in daily life
			Reactions in simple chemical cells
			Redox reactions
			Redox reactions in chemical cells
			Electrolysis
			Importance of redox reactions in modern ways of living
		Chemical Reactions and Energy	Energy changes in chemical reactions
			Standard enthalpy change of neutralization, solution, formation and combustion
			Hess's law
		Rate of Reaction	Rate of chemical reaction
			Factors affecting rate of reaction
			Molar volume of gases at room temperature and pressure
		Chemical Equilibrium	Dynamic equilibrium
			Equilibrium constant
			The effect of changes in concentration and temperature on chemical equilibria
		Chemistry of Carbon Compounds	Introduction to selected homologous series
			Isomerism
			Typical reactions of various functional groups
			Inter-conversions of carbon compounds inter-conversions between the functional groups
			Important organic substances
		Patterns in the Chemical World	Periodic variation in physical properties of the elements from Li to Ar
			Bonding, stoichiometric composition and acid-base properties of the oxides of elements from Na to Cl
			General properties of transition metals
	Physics S4-S6	Electricity and	Electrostatics

Economy	Courses	Strands	Sub-Strands
Hong Kong		Magnetism	Circuits and domestic electricity
			Electromagnetism
		Radioactivity and Nuclear Energy	Radiation and Radioactivity
			Atomic model
			Nuclear energy
		Wave Motion	Nature and properties of waves
			Light
			Sound
		Energy and Momentum	Projectile motion
			Work, energy and power
			Momentum
			Uniform circular motion
			Gravitation
Malaysia	Biology Form 4	Introducing Biology	
		Investigating the cell as a basic unit of living things	Cell structure and cell organization
			Movement of substances across the plasma membrane
			Chemical composition of the cell
			Cell division
		Investigating the physiology of things	Nutrition
			Respiration
		Investigating the relationship between living things and the environment	Dynamic ecosystem
			Endangered ecosystem
	Biology Form 5	Physiology of living things	Transport
			Locomotion and support
			Coordination and response
			Reproduction and growth
		Variation and inheritance	Inheritance
			Variation
	Chemistry Form 4	Introducing Chemistry	
		Matter around us	The structure of an atom
			Chemical formula and equations
			Periodic table of elements
			Chemical bonds
		Interaction between chemicals	Electrochemistry
			Acids and Bases
			Salts
		Production and management of manufactured chemicals	Manufactured substances in industry
	Chemistry Form 5	Interaction between chemicals	Rate of reaction
			Carbon compounds

Economy	Courses	Strands	Sub-Strands
Malaysia			Oxidation and reduction
			Thermochemistry
		Production and management of manufactured chemicals	Chemicals for consumers
	Physics Form 4	Introduction to physics	
		Force and motion	
		Forces and pressure	
		Heat	
		Light	
	Physics Form 5		

APPENDIX D: TOPICS NOT ADDRESSES BY ANY ECONOMY: MATHEMATICS

None of the economies' standards addressed the following mathematics topics in their corresponding grade level standards. The table below shows some topics did not surface in any grade span, such as "Functions of Several Variables." Others did not surface in one or two grade spans but did in the other(s), such as "Operations," which did not appear in any grade 10-12 standards but did appear in both grade 1-6 and grade 7-9 standards.

The list below is an unfiltered, comprehensive list of all unaddressed topics at each grade span. Even topics one would not expect certain grade level standards to cover have been included. For instance, it would be quite unusual to find *Vectors* in standards from grade span 1-6, but we have listed it below to confirm no economies' standards addressed it in grades 1-4.

GRADES 1-6 12 Economies	GRADES 7-9 12 Economies	GRADES 10-12 11 Economies
Numbers		
		Operations
		Common Fractions
		Relationships of Common & Decimal Fractions
		Properties of Common & Decimal Fractions
Binary Arithmetic and/or Other Number Bases		Binary Arithmetic and/or Other Number Bases
Exponents, Roots & Radicals		
Real exponents		
Complex Numbers & Their Properties	Complex Numbers & Their Properties	
Systematic Counting		
Matrices	Matrices	
		Estimating Quantity & Size
Exponents & Orders of Magnitude		
Measurement		
		Concept of measure
		Use of appropriate instruments
		Dimensional analysis
Geometry: Position, Visualization & Shape		
Conic sections and their equations		
Pythagorean Theorem and its applications		
Coordinate systems in three dimensions	Coordinate systems in three dimensions	
Equations of lines, planes and surfaces in space	Equations of lines, planes and surfaces in space	
Vectors	Vectors	
Simple Topology		Simple Topology

GRADES 1-6 12 Economies	**GRADES 7-9** 12 Economies	**GRADES 10-12** 11 Economies
Geometry: Transformations		
		Patterns, tessellations, friezes, stencils, etc
Proportionality		
Slope and gradient in straight line graphs		
Trigonometry of right triangles		
Linear Interpolation & Extrapolation		
Functions, Relations, & Equations		
Relations and their properties		
Functions and their properties		
Families of functions (graphs and properties)		
Operations on functions		
Related functions (inverse, derivative, etc.)	Related functions (inverse, derivative, etc.)	
Relationship of functions and equations (e.g., zeros[/max/min/asymptotes] of functions as roots of equations)		
Interpretation of function graphs		
Functions of several variables	Functions of several variables	Functions of several variables
Recursion	Recursion	
Linear Functions		
Quadratic Functions		
Logarithmic and Exponential Functions		
Trigonometric Functions	Trigonometric Functions	
Quadratic equations and their formal (closed) solutions		
Polynomial equations and their solutions		
Trigonometrical equations and identities	Trigonometrical equations and identities	
Logarithmic and exponential equations and their solutions	Logarithmic and exponential equations and their solutions	
Solution of equations reducing to quadratics, radical equations, absolute value equations, etc.		
Other solution methods for equations (e.g., successive approximation)	Other solution methods for equations (e.g., successive approximation)	
Inequalities and[/or] their graphical representation		
Systems of equations and their solutions		
Systems of inequalities		

GRADES 1-6 12 Economies	GRADES 7-9 12 Economies	GRADES 10-12 11 Economies
General equation of the second degree and its interpretation		
Angle measures: radians and degrees	Angle measures: radians and degrees	
Law of sines and cosines	Law of sines and cosines	
Unit circle and trigonometric functions	Unit circle and trigonometric functions	
Parametric equations	Parametric equations	
Polar coordinates		
Polar equations and their graphs	Polar equations and their graphs	
Data Representation, Probability, & Statistics		
Sampling, randomness, and bias related to data samples		
Fitting lines and curves to data		
Correlations and other measures of relations	Correlations and other measures of relations	
Mutually exclusive events	Mutually exclusive events	
Conditional probability and independent events		
Bayes' Theorem	Bayes' Theorem	
Contingency tables	Contingency tables	
Probability distributions for discrete random variables		
Probability distributions for continuous random variables		
Expectation and the algebra of expectations		
Sampling (distributions and populations)		
Estimation of population parameters	Estimation of population parameters	
Hypothesis testing	Hypothesis testing	
Confidence intervals	Confidence intervals	
Bivariate distributions	Bivariate distributions	
Markov processes	Markov processes	
Monte Carlo methods and computer simulations		Monte Carlo methods and computer simulations
Elementary Analysis		
Arithmetic and geometric sequences		
Arithmetic and geometric series		
Binomial Theorem	Binomial Theorem	
Other sequences and series	Other sequences and series	
Limits and convergence of series	Limits and convergence of series	
Limits and convergence of functions	Limits and convergence of functions	
Continuity	Continuity	
Growth and decay	Growth and decay	
Differentiation	Differentiation	

GRADES 1-6 12 Economies	GRADES 7-9 12 Economies	GRADES 10-12 11 Economies
Integration	Integration	
Differential equations	Differential equations	
Partial differentiation	Partial differentiation	Partial differentiation
Validation & Structure		
Logical connectives		
Quantifiers ("for all", "there exists")		
Boolean algebra and truth tables	Boolean algebra and truth tables	
Inference schemes (e.g., modus ponens, modus tollens)	Inference schemes (e.g., modus ponens, modus tollens)	
Direct deductive proofs		
Indirect proofs and proof by contradiction		
Proof by mathematical induction	Proof by mathematical induction	
Consistency and independence of axiom systems	Consistency and independence of axiom systems	
Sets, set notation, and set combinations		
Equivalence relations, partitions, and classes	Equivalence relations, partitions, and classes	
Groups	Groups	Groups
Fields	Fields	Fields
Linear (vectors) spaces	Linear (vectors) spaces	Linear (vectors) spaces
Subgroups, subspaces, etc.	Subgroups, subspaces, etc.	
Other axiomatic systems	Other axiomatic systems	Other axiomatic systems
Isomorphism	Isomorphism	Isomorphism
Homomorphism	Homomorphism	Homomorphism
Other Content		
Informatics	Informatics	
Special application of mathematics	Special application of mathematics	
	Problem solving heuristics	Problem solving heuristics
Non-mathematical science content		
Non-mathematical content other than science		

APPENDIX D (CONTINUED): TOPICS NOT ADDRESSES BY ANY ECONOMY: SCIENCE

None of the economies' standards addressed the following mathematics topics in their corresponding grade level standards. The table below shows some topics did not surface in any grade span, such as "Genetic Engineering." Others did not surface in one or two grade spans but did in the other(s), such as "Ice Forms," which did not appear in any grade 1-4 standards but did appear in both grade 5-6 and grade 7-10 standards.

The list below is an unfiltered, comprehensive list of all unaddressed topics at each grade span. Even topics one would not expect certain grade level standards to cover have been included. For instance, it would be quite unusual to find *Genetic Engineering* in standards from grade span 1-4, but we have listed it below to confirm no Economies' standards addressed it in grades 1-4.

GRADES 1-4 10 Economies	GRADES 5-6 10 Economies	GRADES 7-10 9 Economies
Earth Sciences		
Ice forms		
Evolution of the universe		
Life Sciences		
Biochemical processes in cells		
Population genetics, biotechnology	Population genetics, biotechnology	
Biochemistry of genetics	Biochemistry of genetics	
Genetic engineering	Genetic engineering	Genetic engineering
Physical Sciences		
Formulas/Equations/Nomenclature, Stoichiometry	Formulas/Equations/Nomenclature, Stoichiometry	
Work, Power, Simple machines		
	Kinetic-molecular theory	
Quantum theory & fundamental particles	Quantum theory & fundamental particles	Quantum theory & fundamental particles
Law of Conservation of Matter		
Explanations of chemical changes	Explanations of chemical changes	
Determinants/trends of chemical reactivity	Determinants/trends of chemical reactivity	
Energy and chemical change	Energy and chemical change	
Calorimetry, exothermic/endothermic reactions		
First law of thermodynamics		
Second law of thermodynamics	Second law of thermodynamics	
Organic & biochemical changes		
Nuclear chemistry	Nuclear chemistry	
Relativity theory	Relativity theory	Relativity theory
Science, Technology, & Mathematics		
	Mathematics, technology influence on science	
Science & Other Disciplines		
Science and Other Disciplines	Science and Other Disciplines	

APPENDIX E: INDIVIDUAL ECONOMY PORTRAITS
MATHEMATICS

The following individual economy profiles show the specific topics addressed by each economy's standards in the corresponding grade spans. The third column, labeled "Core," denotes with the word "YES" the topics included in the set of common topics. Those topics not included in this "Core" are denoted with the word "NO". Five economies marked with an asterisk (*) are examples of high performing economies on PISA and TIMSS.

	Grade Spans 1-6							
	Text	**Core >66%)**	**Economy 1 ***	**Economy 2 ***	**Economy 3 ***	**Economy 4 ***	**Economy 5 ***	**Economy 6**
1	**Numbers**	NO						
2	**Whole Numbers**	NO						
3	Meaning	YES	X	X	X	X	X	X
4	Operations	YES	X	X	X	X	X	X
5	Properties of Operations	NO	X		X		X	
6	**Fractions & Decimals**	NO						
7	Common Fractions	YES	X	X	X	X	X	X
8	Decimal Fractions	YES	X	X	X	X	X	X
9	Relationships of Common & Decimal Fractions	YES	X	X	X	X	X	
10	Percentages	YES	X	X	X	X	X	X
11	Properties of Common & Decimal Fractions	NO					X	
12	**Integer, Rational & Real Numbers**	NO						
13	Negative Numbers, Integers & Their Properties	NO						
14	Rational Numbers & Their Properties	NO						
15	Real Numbers, Their Subsets & Properties	NO	X	X	X		X	
16	**Other Numbers & Number Concepts**	NO						
17	Binary Arithmetic and/or Other Number Bases	NO						
18	Exponents, Roots & Radicals	NO						
19	Real exponents	NO						
20	Complex Numbers & Their Properties	YES	X	X	X	X	X	X

INDIVIDUAL ECONOMY PROFILES
MATHEMATICS

	Text	Core >66%)	Economy 1 *	Economy 2 *	Economy 3 *	Economy 4 *	Economy 5 *	Economy 6
	Grade Spans 1-6							
21	Number Theory	NO						
22	Systematic Counting	NO						
23	Matrices	NO						
24	**Estimation & Number Sense Concepts**	NO	X	X				
25	Estimating Quantity & Size	NO	X	X	X	X	X	
26	Rounding & Significant Figures	YES	X	X	X	X	X	
27	Estimating Computations	NO						
28	Exponents & Orders of Magnitude	NO						
29	**Measurement**	NO						
30	**Measurement Units**	YES	X	X	X	X	X	X
31	Concept of measure (including non-standard units)	YES	X	X	X	X	X	X
32	Standard units (including metric system)	NO	X	X			X	X
33	Use of appropriate instruments	YES	X	X	X	X	X	X
34	Common measures (Length; area; volume; time; calendar; money; temp; mass; weight; angles)	NO	X	X	X	X	X	
35	Quotients and products of units (km/h, m/s, etc.)	NO						
36	Dimensional analysis / Cancellation of Units	NO						
37	**Computations & Properties of Length, Perimeter, Area & Volume**	YES	X	X	X	X	X	
38	Computations, formulas and properties of length and perimeter	YES	X	X	X	X	X	X

	Grade Spans 1-6							
	Text	**Core >66%)**	**Economy 1 ***	**Economy 2 ***	**Economy 3 ***	**Economy 4 ***	**Economy 5 ***	**Economy 6**
39	Computations, formulas and properties of area	NO		X				
40	Computations, formulas and properties of surface area	YES	X	X	X	X	X	X
41	Computations, formulas and properties of volumes	NO						
42	**Estimation & Error**	YES	X	X	X	X	X	
43	Estimation of measurement and errors of measurement	NO						
44	Precision and accuracy of measurement	NO						
45	**Geometry: Position, Visualization & Shape**	NO						
46	**1-D & 2-D Coordinate Geometry**	NO	X		X	X		X
47	Line and coordinate graphs	NO						
48	Equations of lines in a plane	NO						
49	Conic sections and their equations	NO						
50	**2-D Geometry: Basics**	YES	X	X	X	X		
51	Points, lines, segments, half-lines, and rays	YES	X	X	X	X	X	X
52	Angles	YES	X	X	X	X	X	
53	Parallelism and perpendicularity	NO	X					
54	**2-D Geometry: Polygons & Circles**	YES	X	X	X	X	X	X
55	Triangles and quadrilaterals: their classification and properties	NO						

	Grade Spans 1-6							
	Text	**Core >66%)**	**Economy 1 ***	**Economy 2 ***	**Economy 3 ***	**Economy 4 ***	**Economy 5 ***	**Economy 6**
56	Pythagorean Theorem and its applications	**YES**	X	X	X	X	X	X
57	Other polygons and their properties	**YES**	X	X	X	X	X	X
58	Circles and their properties	**NO**						
59	**3-D Geometry**	**YES**	X	X	X	X	X	X
60	3-Dimensional shapes and surfaces and their properties	**NO**			X		X	
61	Planes and lines in space	**YES**	X	X	X	X	X	
62	Spatial perception and visualization	**NO**						
63	Coordinate systems in three dimensions	**NO**						
64	Equations of lines, planes and surfaces in space	**NO**						
65	**Vectors**	**NO**						
66	**Simple Topology**	**NO**						
67	**Geometry: Symmetry, Congruence & Similarity**	**NO**						
68	**Geometry: Transformations**	**NO**		X		X	X	X
69	Patterns, tessellations, friezes, stencils, etc	**YES**	X	X	X	X		
70	Symmetry	**NO**		X	X			X
71	Transformations	**NO**						
72	**Congruence & Similarity**	**NO**		X	X			
73	Congruence	**NO**			X			X
74	Similarities (similar triangles and their properties; other similar figures and properties)	**NO**		X	X	X		

	Grade Spans 1-6							
	Text	**Core >66%)**	**Economy 1 ***	**Economy 2 ***	**Economy 3 ***	**Economy 4 ***	**Economy 5 ***	**Economy 6**
75	**Constructions w/ Straightedge & Compass**	NO						
76	**Proportionality**	NO						
77	**Proportionality Concepts**	NO		X	X	X	X	
78	Meaning of ratio and proportion	NO		X	X			
79	Direct and inverse proportion	NO						
80	**Proportionality Problems**	NO		X		X		
81	Solving proportional equations	NO	X		X	X		
82	Solving practical problems with proportionality	YES	X		X	X		X
83	Scales (maps and plans)	NO			X			
84	Proportion based on similarity	NO						
85	**Slope & Simple Trigonometry**	NO						
86	Slope and gradient in straight line graphs	NO						
87	Trigonometry of right triangles	NO						
88	**Linear Interpolation & Extrapolation**	NO						
89	**Functions, Relations, & Equations**	NO						
90	**Patterns, Relations & Functions**	YES		X	X	X		X
91	Number patterns	NO						
92	Relations and their properties	NO						
93	Functions and their properties	NO						
94	Representation of relations and functions	NO						
95	Families of functions (graphs and properties)	NO						
96	Operations on functions	NO						

	Grade Spans 1-6							
	Text	**Core >66%)**	**Economy 1 ***	**Economy 2 ***	**Economy 3 ***	**Economy 4 ***	**Economy 5 ***	**Economy 6**
97	Related functions (inverse, derivative, etc.)	NO						
98	Relationship of functions and equations	NO						
99	Interpretation of function graphs	NO						
100	Functions of several variables	NO						
101	Recursion	NO						
102	Linear Functions	NO						
103	Quadratic Functions	NO						
104	Logarithmic and Exponential Functions	NO						
105	Trigonometric Functions	NO						
106	**Equations & Formulas**	YES	X	X	X	X	X	
107	Representation of numerical situations by equations	YES	X	X	X	X		
108	Informal solution of simple equations	NO				X		
109	Evaluating expressions	NO	X			X	X	
110	Equivalent expressions (including factorization and simplification)	NO	X		X	X		
111	Linear equations and their formal (closed) solutions	NO						
112	Quadratic equations and their formal (closed) solutions	NO						
113	Polynomial equations and their solutions	NO						
114	Trigonometrical equations and identities	NO						
115	Logarithmic and exponential equations and their solutions	NO						

	Grade Spans 1-6							
	Text	**Core >66%)**	**Economy 1 ***	**Economy 2 ***	**Economy 3 ***	**Economy 4 ***	**Economy 5 ***	**Economy 6**
116	Solution of equations reducing to quadratics, radical equations, absolute value equations, etc.	NO						
117	Other solution methods for equations (e.g., successive approximation)	NO						
118	Inequalities and/or their graphical representation	NO						
119	Systems of equations and their solutions (including matrix solutions)	NO						
120	Systems of inequalities	NO	X		X	X	X	
121	Substituting into or rearranging formulas	NO						
122	General equation of the second degree and its interpretation	NO						
123	**Trigonometry and Analytic Geometry**	NO						
124	Angle measures: radians and degrees	NO						
125	Law of sines and cosines	NO						
126	Unit circle and trigonometric functions	NO						
127	Parametric equations	NO						
128	Polar coordinates	NO						
129	Polar equations and their graphs	NO						
130	**Data Representation, Probability, & Statistics**	NO						
131	**Data Representation & Analysis**	YES	X	X	X	X	X	X
132	Collecting data from experiments and simple surveys	YES	X	X	X	X	X	X
133	Representing data	YES	X	X	X	X	X	X

	Grade Spans 1-6							
	Text	**Core >66%)**	**Economy 1 ***	**Economy 2 ***	**Economy 3 ***	**Economy 4 ***	**Economy 5 ***	**Economy 6**
134	Interpreting tables, charts, plots, graphs	NO	X			X		
135	Kinds of scales (nominal, ordinal, interval, ratio)	YES	X	X	X	X	X	
136	Measures of central tendency	NO						
137	Measures of dispersion	NO						
138	Sampling, randomness, and bias related to data samples	NO						X
139	Prediction and inferences from data	NO						
140	Fitting lines and curves to data	NO						
141	Correlations and other measures of relations	NO						X
142	Use and misuse of statistics	NO						
143	**Uncertainty & Probability**	NO		X				X
144	Informal likelihoods and the vocabulary of likelihoods	NO		X				X
145	Numerical probability and probability models	NO		X				
146	Counting principles	NO						
147	Mutually exclusive events	NO						
148	Conditional probability and independent events	NO						
149	Bayes' Theorem	NO						
150	Contingency tables	NO						
151	Probability distributions for discrete random variables	NO						
152	Probability distributions for continuous random variables	NO						

Grade Spans 1-6								
	Text	**Core >66%)**	**Economy 1 ***	**Economy 2 ***	**Economy 3 ***	**Economy 4 ***	**Economy 5 ***	**Economy 6**
153	Expectation and the algebra of expectations	NO						
154	Sampling (distributions and populations)	NO						
155	Estimation of population parameters	NO						
156	Hypothesis testing	NO						
157	Confidence intervals	NO						
158	Bivariate distributions	NO						
159	Markov processes	NO						
160	Monte Carlo methods and computer simulations	NO						
161	**Elementary Analysis**	NO						
162	**Infinite Processes**	NO						
163	Arithmetic and geometric sequences	NO						
164	Arithmetic and geometric series	NO						
165	Binomial Theorem	NO						
166	Other sequences and series	NO						
167	Limits and convergence of series	NO						
168	Limits and convergence of functions	NO						
169	Continuity	NO						
170	**Change**	NO						
171	Growth and decay	NO						
172	Differentiation	NO						
173	Integration	NO						
174	Differential equations	NO						
175	Partial differentiation	NO						

	Grade Spans 1-6							
	Text	**Core >66%)**	**Economy 1 ***	**Economy 2 ***	**Economy 3 ***	**Economy 4 ***	**Economy 5 ***	**Economy 6**
176	**Validation & Structure**	NO						
177	**Validation & Justification**	NO						
178	Logical connectives	NO						
179	Quantifiers ("for all", "there exists")	NO						
180	Boolean algebra and truth tables	NO						
181	Conditional statements; equivalence of statements (including converse, contrapositive, and inverse)	NO						
182	Inference schemes (e.g., *modus ponens*, *modus tollens*)	NO						
183	Direct deductive proofs	NO						
184	Indirect proofs and proof by contradiction	NO						
185	Proof by mathematical induction	NO						
186	Consistency and independence of axiom systems	NO						
187	**Structuring and Abstracting**	NO						
188	Sets, set notation, and set combinations	NO						
189	Equivalence relations, partitions, and classes	NO						
190	Groups	NO						
191	Fields	NO						
192	Linear (vectors) spaces	NO						
193	Subgroups, subspaces, etc.	NO						
194	Other axiomatic systems	NO						
195	Isomorphism	NO						

	Grade Spans 1-6							
	Text	**Core >66%)**	**Economy 1 ***	**Economy 2 ***	**Economy 3 ***	**Economy 4 ***	**Economy 5 ***	**Economy 6**
196	Homomorphism	NO						
197	**Other Content**	NO						
198	**Informatics (operation of computers, flow charts, learning a programming language, programs, algorithms with applications to the computer, complexity)**	NO	X					
199	**History and nature of mathematics**	NO						
200	**Special application of mathematics (kinematics, Newtonian mechanics, population growth, networks, linear programming, critical path analysis, examples from economics)**	NO		X				
201	**Problem solving heuristics**	NO						
202	**Non-mathematical science content**	NO						
203	**Non-mathematical content other than science**	NO						

			Grade Spans 1-6					
Original	**Text**	**Core >66%**	**Economy 7**	**Economy 8**	**Economy 9**	**Economy 10**	**Economy 11**	**Economy 12**
1.	**Numbers**	NO						
2.	**Whole Numbers**	NO		X				
3.	Meaning	YES	X	X	X	X	X	X
4.	Operations	YES	X	X	X	X	X	X
5.	Properties of Operations	NO	X	X	X	X		X
6.	**Fractions & Decimals**	NO						
7.	Common Fractions	YES	X	X	X	X	X	X
8.	Decimal Fractions	YES	X	X	X	X	X	X
9.	Relationships of Common & Decimal Fractions	YES	X	X		X	X	X
10.	Percentages	YES		X		X	X	X
11.	Properties of Common & Decimal Fractions	NO			X			
12.	**Integer, Rational & Real Numbers**	NO						
13.	Negative Numbers, Integers & Their Properties	NO					X	X
14.	Rational Numbers & Their Properties	NO				X		
15.	Real Numbers, Their Subsets & Properties	NO						
16.	**Other Numbers & Number Concepts**	NO						
17.	Binary Arithmetic and/or Other Number Bases	NO						
18.	Exponents, Roots & Radicals	NO						
19.	Real exponents	NO						

			Grade Spans 1-6					
Original	Text	Core >66%	Economy 7	Economy 8	Economy 9	Economy 10	Economy 11	Economy 12
20.	Complex Numbers & Their Properties	**YES**	X	X	X	X	X	X
21.	Number Theory	NO						
22.	Systematic Counting	NO						
23.	Matrices	NO	X					
24.	**Estimation & Number Sense Concepts**	NO		X		X	X	X
25.	Estimating Quantity & Size	NO	X	X				X
26.	Rounding & Significant Figures	**YES**	X	X	X	X	X	X
27.	Estimating Computations	NO						
28.	Exponents & Orders of Magnitude	NO						
29.	**Measurement**	NO						
30.	**Measurement Units**	**YES**	X	X	X	X	X	X
31.	Concept of measure (including non-standard units)	**YES**	X	X	X	X	X	X
32.	Standard units (including metric system)	NO	X		X	X		
33.	Use of appropriate instruments	**YES**	X	X	X	X	X	X
34.	Common measures (Length; area; volume; time; calendar; money; temp; mass; weight; angles)	NO						
35.	Quotients and products of units (km/h, m/s, etc.)	NO				X		
36.	Dimensional analysis / Cancellation of Units	NO						
37.	**Computations & Properties of Length, Perimeter, Area & Volume**	**YES**	X	X	X	X	X	X

Grade Spans 1-6								
Original	**Text**	**Core >66%**	**Economy 7**	**Economy 8**	**Economy 9**	**Economy 10**	**Economy 11**	**Economy 12**
38.	Computations, formulas and properties of length and perimeter	**YES**	X	X	X	X	X	X
39.	Computations, formulas and properties of area	NO		X		X	X	
40.	Computations, formulas and properties of surface area	**YES**		X	X		X	X
41.	Computations, formulas and properties of volumes	NO						
42.	**Estimation & Error**	**YES**	X	X	X	X	X	X
43.	Estimation of measurement and errors of measurement	NO	X		X			
44.	Precision and accuracy of measurement	NO						
45.	**Geometry: Position, Visualization & Shape**	NO						
46.	**1-D & 2-D Coordinate Geometry**	NO	X				X	X
47.	Line and coordinate graphs	NO						X
48.	Equations of lines in a plane	NO						
49.	Conic sections and their equations	NO				X		
50.	**2-D Geometry: Basics**	**YES**	X	X		X	X	X
51.	Points, lines, segments, half-lines, and rays	**YES**	X		X		X	X
52.	Angles	**YES**	X		X		X	X
53.	Parallelism and perpendicularity	NO			X	X		X
54.	**2-D Geometry: Polygons & Circles**	**YES**	X	X	X	X	X	X
55.	Triangles and quadrilaterals: their classification and properties	NO						

		Grade Spans 1-6						
Original	**Text**	**Core >66%**	**Economy 7**	**Economy 8**	**Economy 9**	**Economy 10**	**Economy 11**	**Economy 12**
56.	Pythagorean Theorem and its applications	YES	X	X	X	X	X	X
57.	Other polygons and their properties	YES	X	X	X	X	X	X
58.	Circles and their properties	NO						X
59.	**3-D Geometry**	YES	X	X	X	X	X	X
60.	3-Dimensional shapes and surfaces and their properties	NO						
61.	Planes and lines in space	YES		X	X	X	X	X
62.	Spatial perception and visualization	NO						
63.	Coordinate systems in three dimensions	NO						
64.	Equations of lines, planes and surfaces in space	NO						
65.	**Vectors**	NO						
66.	**Simple Topology**	NO						
67.	**Geometry: Symmetry, Congruence & Similarity**	NO						
68.	**Geometry: Transformations**	NO	X		X		X	X
69.	Patterns, tessellations, friezes, stencils, etc	YES	X	X	X		X	X
70.	Symmetry	NO	X		X		X	X
71.	Transformations	NO						
72.	**Congruence & Similarity**	NO	X					X
73.	Congruence	NO					X	
74.	Similarities (similar triangles and their properties; other similar figures and properties)	NO	X				X	

Grade Spans 1-6								
Original	**Text**	**Core >66%**	**Economy 7**	**Economy 8**	**Economy 9**	**Economy 10**	**Economy 11**	**Economy 12**
75.	**Constructions w/ Straightedge & Compass**	NO						
76.	**Proportionality**	NO						
77.	**Proportionality Concepts**	NO	X	X			X	X
78.	Meaning of ratio and proportion	NO					X	
79.	Direct and inverse proportion	NO						
80.	**Proportionality Problems**	NO						
81.	Solving proportional equations	NO					X	
82.	Solving practical problems with proportionality	YES		X	X	X	X	
83.	Scales (maps and plans)	NO						
84.	Proportion based on similarity	NO						
85.	**Slope & Simple Trigonometry**	NO						
86.	Slope and gradient in straight line graphs	NO						
87.	Trigonometry of right triangles	NO						
88.	**Linear Interpolation & Extrapolation**	NO						
89.	**Functions, Relations, & Equations**	NO						
90.	**Patterns, Relations & Functions**	YES	X	X	X	X	X	X
91.	Number patterns	NO						
92.	Relations and their properties	NO						
93.	Functions and their properties	NO	X					X
94.	Representation of relations and functions	NO						

Grade Spans 1-6							
Original	Text	Core >66%	Economy 7	Economy 8	Economy 9	Economy 10	Economy 11	Economy 12

Original	Text	Core >66%	Economy 7	Economy 8	Economy 9	Economy 10	Economy 11	Economy 12
95.	Families of functions (graphs and properties)	NO						
96.	Operations on functions	NO						
97.	Related functions (inverse, derivative, etc.)	NO						
98.	Relationship of functions and equations	NO						
99.	Interpretation of function graphs	NO						
100.	Functions of several variables	NO						
101.	Recursion	NO						
102.	Linear Functions	NO						
103.	Quadratic Functions	NO						
104.	Logarithmic and Exponential Functions	NO						
105.	Trigonometric Functions	NO						
106.	**Equations & Formulas**	**YES**	X	X	X	X	X	X
107.	Representation of numerical situations by equations	**YES**	X	X	X		X	X
108.	Informal solution of simple equations	NO						X
109.	Evaluating expressions	NO						
110.	Equivalent expressions (including factorization and simplification)	NO	X			X	X	X
111.	Linear equations and their formal (closed) solutions	NO						
112.	Quadratic equations and their formal (closed) solutions	NO						

		Grade Spans 1-6						
Original	**Text**	**Core >66%**	**Economy 7**	**Economy 8**	**Economy 9**	**Economy 10**	**Economy 11**	**Economy 12**
113.	Polynomial equations and their solutions	NO						
114.	Trigonometrical equations and identities	NO						
115.	Logarithmic and exponential equations and their solutions	NO						
116.	Solution of equations reducing to quadratics, radical equations, absolute value equations, etc.	NO						
117.	Other solution methods for equations (e.g., successive approximation)	NO						
118.	Inequalities and/or their graphical representation	NO						
119.	Systems of equations and their solutions (including matrix solutions)	NO						
120.	Systems of inequalities	NO	X	X			X	X
121.	Substituting into or rearranging formulas	NO						
122.	General equation of the second degree and its interpretation	NO						
123.	**Trigonometry and Analytic Geometry**	NO						
124.	Angle measures: radians and degrees	NO						
125.	Law of sines and cosines	NO						
126.	Unit circle and trigonometric functions	NO						
127.	Parametric equations	NO						

		Grade Spans 1-6						
Original	**Text**	**Core >66%**	**Economy 7**	**Economy 8**	**Economy 9**	**Economy 10**	**Economy 11**	**Economy 12**
128.	Polar coordinates	NO						
129.	Polar equations and their graphs	NO						
130.	**Data Representation, Probability, & Statistics**	NO						
131.	**Data Representation & Analysis**	YES		X	X	X	X	X
132.	Collecting data from experiments and simple surveys	YES	X	X	X	X	X	X
133.	Representing data	YES	X	X	X	X	X	X
134.	Interpreting tables, charts, plots, graphs	NO						
135.	Kinds of scales (nominal, ordinal, interval, ratio)	YES	X	X			X	
136.	Measures of central tendency	NO	X	X	X			
137.	Measures of dispersion	NO						
138.	Sampling, randomness, and bias related to data samples	NO						
139.	Prediction and inferences from data	NO						
140.	Fitting lines and curves to data	NO						
141.	Correlations and other measures of relations	NO					X	
142.	Use and misuse of statistics	NO						
143.	**Uncertainty & Probability**	NO	X		X	X	X	X
144.	Informal likelihoods and the vocabulary of likelihoods	NO	X				X	X
145.	Numerical probability and probability models	NO			X			X

Grade Spans 1-6								
Original	**Text**	**Core >66%**	**Economy 7**	**Economy 8**	**Economy 9**	**Economy 10**	**Economy 11**	**Economy 12**
146.	Counting principles	NO						
147.	Mutually exclusive events	NO						
148.	Conditional probability and independent events	NO						
149.	Bayes' Theorem	NO						
150.	Contingency tables	NO						
151.	Probability distributions for discrete random variables	NO						
152.	Probability distributions for continuous random variables	NO						
153.	Expectation and the algebra of expectations	NO						
154.	Sampling (distributions and populations)	NO						
155.	Estimation of population parameters	NO						
156.	Hypothesis testing	NO						
157.	Confidence intervals	NO						
158.	Bivariate distributions	NO						
159.	Markov processes	NO						
160.	Monte Carlo methods and computer simulations	NO						
161.	**Elementary Analysis**	NO						
162.	**Infinite Processes**	NO						
163.	Arithmetic and geometric sequences	NO						
164.	Arithmetic and geometric series	NO						
165.	Binomial Theorem	NO						

	Grade Spans 1-6							
Original	**Text**	**Core >66%**	**Economy 7**	**Economy 8**	**Economy 9**	**Economy 10**	**Economy 11**	**Economy 12**
166.	Other sequences and series	NO						
167.	Limits and convergence of series	NO						
168.	Limits and convergence of functions	NO						
169.	Continuity	NO						
170.	**Change**	NO						
171.	Growth and decay	NO						
172.	Differentiation	NO						
173.	Integration	NO						
174.	Differential equations	NO						
175.	Partial differentiation	NO						
176.	**Validation & Structure**	NO						
177.	**Validation & Justification**	NO						
178.	Logical connectives	NO						
179.	Quantifiers ("for all", "there exists")	NO						
180.	Boolean algebra and truth tables	NO			X			
181.	Conditional statements; equivalence of statements (including converse, contrapositive, and inverse)	NO						
182.	Inference schemes (e.g., *modus ponens*, *modus tollens*)	NO						
183.	Direct deductive proofs	NO						
184.	Indirect proofs and proof by contradiction	NO						
185.	Proof by mathematical induction	NO						
186.	Consistency and independence of axiom systems	NO						

		Grade Spans 1-6						
Original	Text	Core >66%	Economy 7	Economy 8	Economy 9	Economy 10	Economy 11	Economy 12
187.	**Structuring and Abstracting**	NO						
188.	Sets, set notation, and set combinations	NO						
189.	Equivalence relations, partitions, and classes	NO						
190.	Groups	NO						
191.	Fields	NO						
192.	Linear (vectors) spaces	NO						
193.	Subgroups, subspaces, etc.	NO						
194.	Other axiomatic systems	NO						
195.	Isomorphism	NO						
196.	Homomorphism	NO						
197.	**Other Content**	NO						
198.	**Informatics (operation of computers, flow charts, learning a programming language, programs, algorithms with applications to the computer, complexity)**	NO						
199.	**History and nature of mathematics**	NO						
200.	**Special application of mathematics (kinematics, Newtonian mechanics, population growth, networks, linear programming, critical path analysis, examples from economics)**	NO			X			

Grade Spans 1-6								
Original	Text	Core >66%	Economy 7	Economy 8	Economy 9	Economy 10	Economy 11	Economy 12
201.	**Problem solving heuristics**	**NO**						
202.	**Non-mathematical science content**	**NO**						
203.	**Non-mathematical content other than science**	**NO**						

		Grade Spans 7-9						
Original	Text	Core >66%	Economy 1 *	Economy 2 *	Economy 3 *	Economy 4 *	Economy 5 *	Economy 6
1)	**Numbers**	NO						
2)	**Whole Numbers**	NO						
3)	Meaning	NO		X	X			X
4)	Operations	NO			X			X
5)	Properties of Operations	NO			X			X
6)	**Fractions & Decimals**	NO						
7)	Common Fractions	NO			X			X
8)	Decimal Fractions	NO		X				X
9)	Relationships of Common & Decimal Fractions	NO		X	X	X		X
10)	Percentages	YES	X		X	X		X
11)	Properties of Common & Decimal Fractions	NO			X			
12)	**Integer, Rational & Real Numbers**	NO						
13)	Negative Numbers, Integers & Their Properties	YES	X	X	X	X	X	X
14)	Rational Numbers & Their Properties	NO		X		X		X
15)	Real Numbers, Their Subsets & Properties	YES	X	X	X	X	X	
16)	**Other Numbers & Number Concepts**	NO						
17)	Binary Arithmetic and/or Other Number Bases	NO	X	X				
18)	Exponents, Roots & Radicals	YES	X	X	X	X	X	X
19)	Real exponents	NO						
20)	Complex Numbers & Their Properties	YES	X	X	X	X		X

Grade Spans 7-9								
Original	Text	Core >66%	Economy 1 *	Economy 2 *	Economy 3 *	Economy 4 *	Economy 5 *	Economy 6
21)	Number Theory	NO				X		
22)	Systematic Counting	NO						
23)	Matrices	NO						
24)	**Estimation & Number Sense Concepts**	NO		X	X			
25)	Estimating Quantity & Size	YES	X	X	X	X		X
26)	Rounding & Significant Figures	NO	X			X		
27)	Estimating Computations	NO	X		X			
28)	Exponents & Orders of Magnitude	NO						
29)	**Measurement**	NO						
30)	**Measurement Units**	NO	X					
31)	Concept of measure (including non-standard units)	NO	X			X		
32)	Standard units (including metric system)	NO				X		X
33)	Use of appropriate instruments	YES	X	X				X
34)	Common measures (Length; area; volume; time; calendar; money; temp; mass; weight; angles)	NO				X		
35)	Quotients and products of units (km/h, m/s, etc.)	NO			X			
36)	Dimensional analysis / Cancellation of Units	NO	X					X
37)	**Computations & Properties of Length, Perimeter, Area & Volume**	YES	X	X	X	X		X

Grade Spans 7-9								
Original	Text	Core >66%	Economy 1 *	Economy 2 *	Economy 3 *	Economy 4 *	Economy 5 *	Economy 6
38)	Computations, formulas and properties of length and perimeter	**YES**	X	X	X	X	X	
39)	Computations, formulas and properties of area	**YES**	X	X	X	X	X	
40)	Computations, formulas and properties of surface area	**YES**	X	X	X	X	X	
41)	Computations, formulas and properties of volumes	NO						
42)	**Estimation & Error**	NO	X					
43)	Estimation of measurement and errors of measurement	NO	X	X				
44)	Precision and accuracy of measurement	NO						
45)	**Geometry: Position, Visualization & Shape**	NO						
46)	**1-D & 2-D Coordinate Geometry**	**YES**	X	X	X	X	X	X
47)	Line and coordinate graphs	NO		X	X	X		
48)	Equations of lines in a plane	NO			X	X		
49)	Conic sections and their equations	NO				X		X
50)	**2-D Geometry: Basics**	**YES**	X	X	X	X	X	X
51)	Points, lines, segments, half-lines, and rays	**YES**	X	X	X	X	X	X
52)	Angles	**YES**	X	X	X	X	X	
53)	Parallelism and perpendicularity	NO	X			X	X	X
54)	**2-D Geometry: Polygons & Circles**	**YES**	X	X	X	X	X	X
55)	Triangles and quadrilaterals: their classification and properties	**YES**	X	X	X	X	X	X

		Grade Spans 7-9						
Original	**Text**	**Core >66%**	**Economy 1 ***	**Economy 2 ***	**Economy 3 ***	**Economy 4 ***	**Economy 5 ***	**Economy 6**
56)	Pythagorean Theorem and its applications	YES	X	X	X	X	X	X
57)	Other polygons and their properties	YES	X	X	X		X	X
58)	Circles and their properties	NO						
59)	**3-D Geometry**	YES	X	X	X	X	X	X
60)	3-Dimensional shapes and surfaces and their properties	NO					X	
61)	Planes and lines in space	YES	X	X	X		X	X
62)	Spatial perception and visualization	NO						
63)	Coordinate systems in three dimensions	NO						
64)	Equations of lines, planes and surfaces in space	NO						
65)	**Vectors**	NO						
66)	**Simple Topology**	NO						
67)	**Geometry: Symmetry, Congruence & Similarity**	NO						
68)	**Geometry: Transformations**	NO	X					X
69)	Patterns, tessellations, friezes, stencils, etc	YES	X		X	X	X	
70)	Symmetry	YES	X		X	X		X
71)	Transformations	NO						
72)	**Congruence & Similarity**	YES	X	X	X	X	X	
73)	Congruence	YES	X	X	X	X	X	
74)	Similarities (similar triangles and their properties; other similar figures and properties)	YES	X	X	X	X	X	

		Grade Spans 7-9						
Original	Text	Core >66%	Economy 1 *	Economy 2 *	Economy 3 *	Economy 4 *	Economy 5 *	Economy 6
75)	**Constructions w/ Straightedge & Compass**	NO						
76)	**Proportionality**	NO						
77)	**Proportionality Concepts**	YES	X	X	X	X	X	X
78)	Meaning of ratio and proportion	NO				X	X	X
79)	Direct and inverse proportion	NO						
80)	**Proportionality Problems**	NO	X				X	
81)	Solving proportional equations	YES	X	X	X	X		X
82)	Solving practical problems with proportionality	NO				X		X
83)	Scales (maps and plans)	YES	X	X	X	X	X	
84)	Proportion based on similarity	NO						
85)	**Slope & Simple Trigonometry**	NO	X			X	X	
86)	Slope and gradient in straight line graphs	NO	X	X			X	X
87)	Trigonometry of right triangles	NO						
88)	**Linear Interpolation & Extrapolation**	NO						
89)	**Functions, Relations, & Equations**	NO						
90)	**Patterns, Relations & Functions**	YES	X		X	X		X
91)	Number patterns	NO			X			
92)	Relations and their properties	YES	X	X	X			X
93)	Functions and their properties	YES		X	X		X	X
94)	Representation of relations and functions	NO						
95)	Families of functions (graphs and	NO	X	X	X		X	

		Grade Spans 7-9						
Original	**Text**	**Core >66%**	**Economy 1 ***	**Economy 2 ***	**Economy 3 ***	**Economy 4 ***	**Economy 5 ***	**Economy 6**
	properties)							
96)	Operations on functions	NO						
97)	Related functions (inverse, derivative, etc.)	NO		X	X	X	X	
98)	Relationship of functions and equations	YES	X	X	X	X	X	
99)	Interpretation of function graphs	NO						
100)	Functions of several variables	NO						
101)	Recursion	YES	X	X	X	X	X	X
102)	Linear Functions	NO		X	X	X	X	
103)	Quadratic Functions	NO						
104)	Logarithmic and Exponential Functions	NO						
105)	Trigonometric Functions	NO						
106)	**Equations & Formulas**	YES	X	X	X	X	X	X
107)	Representation of numerical situations by equations	NO		X			X	
108)	Informal solution of simple equations	YES	X	X	X	X		
109)	Evaluating expressions	YES	X	X	X	X	X	
110)	Equivalent expressions (including factorization and simplification)	YES	X	X	X	X	X	X
111)	Linear equations and their formal (closed) solutions	NO		X	X	X	X	
112)	Quadratic equations and their formal (closed) solutions	NO	X	X	X			
113)	Polynomial equations and their solutions	NO						

		Grade Spans 7-9						
Original	**Text**	**Core >66%**	**Economy 1 ***	**Economy 2 ***	**Economy 3 ***	**Economy 4 ***	**Economy 5 ***	**Economy 6**
114)	Trigonometrical equations and identities	NO						
115)	Logarithmic and exponential equations and their solutions	NO				X		
116)	Solution of equations reducing to quadratics, radical equations, absolute value equations, etc.	NO						
117)	Other solution methods for equations (e.g., successive approximation)	NO	X	X	X	X		
118)	Inequalities and/or their graphical representation	YES	X	X	X	X	X	
119)	Systems of equations and their solutions (including matrix solutions)	NO		X				
120)	Systems of inequalities	NO	X		X	X		X
121)	Substituting into or rearranging formulas	NO			X			
122)	General equation of the second degree and its interpretation	NO						
123)	**Trigonometry and Analytic Geometry**	NO						
124)	Angle measures: radians and degrees	NO						
125)	Law of sines and cosines	NO						
126)	Unit circle and trigonometric functions	NO						
127)	Parametric equations	NO	X					
128)	Polar coordinates	NO						
129)	Polar equations and their graphs	NO						
130)	**Data Representation, Probability, &**	NO	X					

	Grade Spans 7-9							
Original	**Text**	**Core >66%**	**Economy 1 ***	**Economy 2 ***	**Economy 3 ***	**Economy 4 ***	**Economy 5 ***	**Economy 6**
	Statistics							
131)	**Data Representation & Analysis**	YES	X	X		X		X
132)	Collecting data from experiments and simple surveys	YES	X	X	X	X		X
133)	Representing data	YES	X	X	X	X		X
134)	Interpreting tables, charts, plots, graphs	NO						
135)	Kinds of scales (nominal, ordinal, interval, ratio)	YES	X	X	X	X		X
136)	Measures of central tendency	NO		X	X			X
137)	Measures of dispersion	NO			X			X
138)	Sampling, randomness, and bias related to data samples	NO	X			X		X
139)	Prediction and inferences from data	NO						
140)	Fitting lines and curves to data	NO						
141)	Correlations and other measures of relations	YES	X		X	X		X
142)	Use and misuse of statistics	NO						
143)	**Uncertainty & Probability**	YES	X	X	X	X	X	X
144)	Informal likelihoods and the vocabulary of likelihoods	YES	X	X	X	X	X	X
145)	Numerical probability and probability models	NO	X	X			X	
146)	Counting principles	NO						
147)	Mutually exclusive events	NO						
148)	Conditional probability and independent events	NO						
149)	Bayes' Theorem	NO						

		Grade Spans 7-9						
Original	Text	Core >66%	Economy 1 *	Economy 2 *	Economy 3 *	Economy 4 *	Economy 5 *	Economy 6
150)	Contingency tables	NO						X
151)	Probability distributions for discrete random variables	NO						X
152)	Probability distributions for continuous random variables	NO	X					
153)	Expectation and the algebra of expectations	NO						X
154)	Sampling (distributions and populations)	NO						
155)	Estimation of population parameters	NO						
156)	Hypothesis testing	NO						
157)	Confidence intervals	NO						
158)	Bivariate distributions	NO						
159)	Markov processes	NO						
160)	Monte Carlo methods and computer simulations	NO						
161)	**Elementary Analysis**	NO						
162)	**Infinite Processes**	NO	X		X			
163)	Arithmetic and geometric sequences	NO			X			
164)	Arithmetic and geometric series	NO						
165)	Binomial Theorem	NO						
166)	Other sequences and series	NO						
167)	Limits and convergence of series	NO						
168)	Limits and convergence of functions	NO						
169)	Continuity	NO						
170)	**Change**	NO						

		Grade Spans 7-9						
Original	Text	Core >66%	Economy 1 *	Economy 2 *	Economy 3 *	Economy 4 *	Economy 5 *	Economy 6
171)	Growth and decay	NO						
172)	Differentiation	NO						
173)	Integration	NO						
174)	Differential equations	NO						
175)	Partial differentiation	NO						
176)	**Validation & Structure**	NO	X	X			X	
177)	**Validation & Justification**	NO				X		
178)	Logical connectives	NO			X			
179)	Quantifiers ("for all", "there exists")	NO						
180)	Boolean algebra and truth tables	NO		X	X			
181)	Conditional statements; equivalence of statements (including converse, contrapositive, and inverse)	NO						
182)	Inference schemes (e.g., *modus ponens*, *modus tollens*)	NO	X	X				
183)	Direct deductive proofs	NO						
184)	Indirect proofs and proof by contradiction	NO						
185)	Proof by mathematical induction	NO						
186)	Consistency and independence of axiom systems	NO						
187)	**Structuring and Abstracting**	NO		X		X		
188)	Sets, set notation, and set combinations	NO						
189)	Equivalence relations, partitions, and classes	NO						
190)	Groups	NO						

Grade Spans 7-9								
Original	**Text**	**Core >66%**	**Economy 1 ***	**Economy 2 ***	**Economy 3 ***	**Economy 4 ***	**Economy 5 ***	**Economy 6**
191)	Fields	NO						
192)	Linear (vectors) spaces	NO						
193)	Subgroups, subspaces, etc.	NO						
194)	Other axiomatic systems	NO						
195)	Isomorphism	NO						
196)	Homomorphism	NO						
197)	**Other Content**	NO						
198)	**Informatics (operation of computers, flow charts, learning a programming language, programs, algorithms with applications to the computer, complexity)**	NO	X		X			
199)	**History and nature of mathematics**	NO						
200)	**Special application of mathematics (kinematics, Newtonian mechanics, population growth, networks, linear programming, critical path analysis, examples from economics)**	NO						
201)	**Problem solving heuristics**	NO		X				
202)	**Non-mathematical science content**	NO						
203)	**Non-mathematical content other than science**	NO						

		Grade Spans 7-9						
Original	Text	Core >66%	Economy 7	Economy 8	Economy 9	Economy 10	Economy 11	Economy 12
1.	**Numbers**	NO						
2.	**Whole Numbers**	NO		X				
3.	Meaning	NO	X	X				X
4.	Operations	NO		X	X			X
5.	Properties of Operations	NO	X					X
6.	**Fractions & Decimals**	NO						
7.	Common Fractions	NO	X	X	X		X	X
8.	Decimal Fractions	NO	X	X	X		X	X
9.	Relationships of Common & Decimal Fractions	NO		X	X		X	X
10.	Percentages	YES	X	X	X	X		X
11.	Properties of Common & Decimal Fractions	NO			X			X
12.	**Integer, Rational & Real Numbers**	NO						
13.	Negative Numbers, Integers & Their Properties	YES	X	X	X	X	X	X
14.	Rational Numbers & Their Properties	NO	X	X	X	X		X
15.	Real Numbers, Their Subsets & Properties	YES	X	X	X	X	X	X
16.	**Other Numbers & Number Concepts**	NO						
17.	Binary Arithmetic and/or Other Number Bases	NO						
18.	Exponents, Roots & Radicals	YES	X	X	X	X	X	X
19.	Real exponents	NO						

		Grade Spans 7-9						
Original	Text	Core >66%	Economy 7	Economy 8	Economy 9	Economy 10	Economy 11	Economy 12
20.	Complex Numbers & Their Properties	YES	X	X	X			X
21.	Number Theory	NO						X
22.	Systematic Counting	NO						
23.	Matrices	NO						
24.	**Estimation & Number Sense Concepts**	NO	X		X		X	X
25.	Estimating Quantity & Size	YES	X	X	X	X	X	X
26.	Rounding & Significant Figures	NO	X	X	X	X	X	X
27.	Estimating Computations	NO	X		X	X	X	
28.	Exponents & Orders of Magnitude	NO						
29.	**Measurement**	NO						
30.	**Measurement Units**	NO			X			
31.	Concept of measure (including non-standard units)	NO	X	X	X	X		
32.	Standard units (including metric system)	NO			X			
33.	Use of appropriate instruments	YES	X	X	X	X	X	X
34.	Common measures (Length; area; volume; time; calendar; money; temp; mass; weight; angles)	NO	X	X	X			
35.	Quotients and products of units (km/h, m/s, etc.)	NO			X		X	
36.	Dimensional analysis / Cancellation of Units	NO			X			

INDIVIDUAL ECONOMY PROFILES
MATHEMATICS

Grade Spans 7-9								
Original	**Text**	**Core >66%**	**Economy 7**	**Economy 8**	**Economy 9**	**Economy 10**	**Economy 11**	**Economy 12**
37.	**Computations & Properties of Length, Perimeter, Area & Volume**	**YES**	X	X	X	X	X	X
38.	Computations, formulas and properties of length and perimeter	**YES**	X	X	X	X	X	X
39.	Computations, formulas and properties of area	**YES**	X	X	X	X	X	X
40.	Computations, formulas and properties of surface area	**YES**	X	X	X	X	X	X
41.	Computations, formulas and properties of volumes	**NO**			X		X	
42.	**Estimation & Error**	**NO**	X	X	X	X	X	
43.	Estimation of measurement and errors of measurement	**NO**	X		X		X	
44.	Precision and accuracy of measurement	**NO**	X				X	
45.	**Geometry: Position, Visualization & Shape**	**NO**						
46.	**1-D & 2-D Coordinate Geometry**	**YES**	X	X	X		X	X
47.	Line and coordinate graphs	**NO**					X	
48.	Equations of lines in a plane	**NO**						
49.	Conic sections and their equations	**NO**			X			X
50.	**2-D Geometry: Basics**	**YES**	X	X	X		X	X
51.	Points, lines, segments, half-lines, and rays	**YES**	X	X	X		X	X
52.	Angles	**YES**	X	X	X	X	X	X
53.	Parallelism and perpendicularity	**NO**		X	X		X	X
54.	**2-D Geometry: Polygons & Circles**	**YES**	X	X	X	X	X	X

Grade Spans 7-9								
Original	Text	Core >66%	Economy 7	Economy 8	Economy 9	Economy 10	Economy 11	Economy 12
55.	Triangles and quadrilaterals: their classification and properties	YES	X	X	X	X	X	X
56.	Pythagorean Theorem and its applications	YES	X	X	X	X	X	X
57.	Other polygons and their properties	YES	X	X	X	X	X	X
58.	Circles and their properties	NO			X		X	
59.	**3-D Geometry**	YES	X	X	X	X	X	X
60.	3-Dimensional shapes and surfaces and their properties	NO			X			
61.	Planes and lines in space	YES	X	X	X		X	X
62.	Spatial perception and visualization	NO						
63.	Coordinate systems in three dimensions	NO						
64.	Equations of lines, planes and surfaces in space	NO						
65.	**Vectors**	NO			X		X	
66.	**Simple Topology**	NO	X					
67.	**Geometry: Symmetry, Congruence & Similarity**	NO						
68.	**Geometry: Transformations**	NO	X	X	X		X	X
69.	Patterns, tessellations, friezes, stencils, etc	YES	X	X	X		X	X
70.	Symmetry	YES	X	X	X	X	X	X
71.	Transformations	NO						
72.	**Congruence & Similarity**	YES	X	X	X	X	X	
73.	Congruence	YES	X	X	X	X	X	X

INDIVIDUAL ECONOMY PROFILES
MATHEMATICS

Grade Spans 7-9								
Original	Text	Core >66%	Economy 7	Economy 8	Economy 9	Economy 10	Economy 11	Economy 12
74.	Similarities (similar triangles and their properties; other similar figures and properties)	YES		X	X	X	X	X
75.	**Constructions w/ Straightedge & Compass**	NO						
76.	**Proportionality**	NO						
77.	**Proportionality Concepts**	YES	X	X	X	X		X
78.	Meaning of ratio and proportion	NO					X	
79.	Direct and inverse proportion	NO						
80.	**Proportionality Problems**	NO	X	X				
81.	Solving proportional equations	YES	X	X	X		X	X
82.	Solving practical problems with proportionality	NO	X	X	X			X
83.	Scales (maps and plans)	YES	X	X			X	
84.	Proportion based on similarity	NO						
85.	**Slope & Simple Trigonometry**	NO	X					
86.	Slope and gradient in straight line graphs	NO		X			X	
87.	Trigonometry of right triangles	NO	X				X	
88.	**Linear Interpolation & Extrapolation**	NO						
89.	**Functions, Relations, & Equations**	NO						
90.	**Patterns, Relations & Functions**	YES	X	X	X	X	X	X
91.	Number patterns	NO			X			
92.	Relations and their properties	YES	X	X	X		X	
93.	Functions and their properties	YES	X	X	X	X	X	X

INDIVIDUAL ECONOMY PROFILES
MATHEMATICS

	Grade Spans 7-9							
Original	Text	Core >66%	Economy 7	Economy 8	Economy 9	Economy 10	Economy 11	Economy 12
94.	Representation of relations and functions	NO	X				X	
95.	Families of functions (graphs and properties)	NO					X	
96.	Operations on functions	NO						
97.	Related functions (inverse, derivative, etc.)	NO	X					
98.	Relationship of functions and equations	YES		X	X	X	X	X
99.	Interpretation of function graphs	NO						
100.	Functions of several variables	NO						
101.	Recursion	YES	X		X	X	X	X
102.	Linear Functions	NO			X		X	
103.	Quadratic Functions	NO	X		X			
104.	Logarithmic and Exponential Functions	NO						
105.	Trigonometric Functions	NO						X
106.	**Equations & Formulas**	YES	X	X	X		X	X
107.	Representation of numerical situations by equations	NO	X					X
108.	Informal solution of simple equations	YES	X	X	X		X	X
109.	Evaluating expressions	YES	X	X	X		X	X
110.	Equivalent expressions (including factorization and simplification)	YES	X	X	X	X	X	X
111.	Linear equations and their formal (closed) solutions	NO		X	X		X	

	Grade Spans 7-9							
Original	**Text**	**Core >66%**	**Economy 7**	**Economy 8**	**Economy 9**	**Economy 10**	**Economy 11**	**Economy 12**
112.	Quadratic equations and their formal (closed) solutions	NO			X			X
113.	Polynomial equations and their solutions	NO						
114.	Trigonometrical equations and identities	NO						
115.	Logarithmic and exponential equations and their solutions	NO						
116.	Solution of equations reducing to quadratics, radical equations, absolute value equations, etc.	NO						
117.	Other solution methods for equations (e.g., successive approximation)	NO		X	X		X	X
118.	Inequalities and/or their graphical representation	YES		X	X	X	X	
119.	Systems of equations and their solutions (including matrix solutions)	NO		X			X	
120.	Systems of inequalities	NO	X	X	X			X
121.	Substituting into or rearranging formulas	NO						
122.	General equation of the second degree and its interpretation	NO						
123.	**Trigonometry and Analytic Geometry**	NO						
124.	Angle measures: radians and degrees	NO						
125.	Law of sines and cosines	NO						
126.	Unit circle and trigonometric	NO						

		Grade Spans 7-9						
Original	Text	Core >66%	Economy 7	Economy 8	Economy 9	Economy 10	Economy 11	Economy 12
	functions							
127.	Parametric equations	NO						
128.	Polar coordinates	NO						
129.	Polar equations and their graphs	NO						
130.	**Data Representation, Probability, & Statistics**	NO						X
131.	**Data Representation & Analysis**	YES	X	X	X	X	X	X
132.	Collecting data from experiments and simple surveys	YES	X	X	X	X	X	X
133.	Representing data	YES	X	X	X	X	X	X
134.	Interpreting tables, charts, plots, graphs	NO						X
135.	Kinds of scales (nominal, ordinal, interval, ratio)	YES	X	X	X	X	X	X
136.	Measures of central tendency	NO	X		X		X	X
137.	Measures of dispersion	NO	X		X	X	X	X
138.	Sampling, randomness, and bias related to data samples	NO	X		X	X	X	
139.	Prediction and inferences from data	NO	X					
140.	Fitting lines and curves to data	NO						
141.	Correlations and other measures of relations	YES	X		X	X	X	X
142.	Use and misuse of statistics	NO						
143.	**Uncertainty & Probability**	YES	X		X	X	X	X
144.	Informal likelihoods and the vocabulary of likelihoods	YES	X		X	X	X	X

		Grade Spans 7-9						
Original	Text	Core >66%	Economy 7	Economy 8	Economy 9	Economy 10	Economy 11	Economy 12
145.	Numerical probability and probability models	NO			X		X	
146.	Counting principles	NO						
147.	Mutually exclusive events	NO	X					
148.	Conditional probability and independent events	NO						
149.	Bayes' Theorem	NO						
150.	Contingency tables	NO						
151.	Probability distributions for discrete random variables	NO						
152.	Probability distributions for continuous random variables	NO						
153.	Expectation and the algebra of expectations	NO						X
154.	Sampling (distributions and populations)	NO						
155.	Estimation of population parameters	NO						
156.	Hypothesis testing	NO						
157.	Confidence intervals	NO						
158.	Bivariate distributions	NO						
159.	Markov processes	NO	X					
160.	Monte Carlo methods and computer simulations	NO						
161.	**Elementary Analysis**	NO						
162.	**Infinite Processes**	NO						

Grade Spans 7-9								
Original	Text	Core >66%	Economy 7	Economy 8	Economy 9	Economy 10	Economy 11	Economy 12
163.	Arithmetic and geometric sequences	NO						
164.	Arithmetic and geometric series	NO						
165.	Binomial Theorem	NO						
166.	Other sequences and series	NO						
167.	Limits and convergence of series	NO						
168.	Limits and convergence of functions	NO						
169.	Continuity	NO						
170.	**Change**	NO						
171.	Growth and decay	NO						
172.	Differentiation	NO						
173.	Integration	NO						
174.	Differential equations	NO						
175.	Partial differentiation	NO						
176.	**Validation & Structure**	NO					X	
177.	**Validation & Justification**	NO						
178.	Logical connectives	NO						
179.	Quantifiers ("for all", "there exists")	NO						
180.	Boolean algebra and truth tables	NO					X	
181.	Conditional statements; equivalence of statements (including converse, contrapositive, and inverse)	NO						
182.	Inference schemes (e.g., *modus ponens*, *modus tollens*)	NO					X	
183.	Direct deductive proofs	NO					X	
184.	Indirect proofs and proof by contradiction	NO						

	Grade Spans 7-9							
Original	**Text**	**Core >66%**	**Economy 7**	**Economy 8**	**Economy 9**	**Economy 10**	**Economy 11**	**Economy 12**
185.	Proof by mathematical induction	NO						
186.	Consistency and independence of axiom systems	NO						
187.	**Structuring and Abstracting**	NO						
188.	Sets, set notation, and set combinations	NO						
189.	Equivalence relations, partitions, and classes	NO						
190.	Groups	NO						
191.	Fields	NO						
192.	Linear (vectors) spaces	NO						
193.	Subgroups, subspaces, etc.	NO						
194.	Other axiomatic systems	NO						
195.	Isomorphism	NO						
196.	Homomorphism	NO						
197.	**Other Content**	NO						
198.	**Informatics (operation of computers, flow charts, learning a programming language, programs, algorithms with applications to the computer, complexity)**	NO						
199.	**History and nature of mathematics**	NO						
200.	**Special application of mathematics (kinematics, Newtonian mechanics, population growth, networks, linear programming, critical path analysis, examples from economics)**	NO						

Grade Spans 7-9								
Original	Text	Core >66%	Economy 7	Economy 8	Economy 9	Economy 10	Economy 11	Economy 12
201.	**Problem solving heuristics**	NO						
202.	**Non-mathematical science content**	NO						X
203.	**Non-mathematical content other than science**	NO						

Grade Spans 10-12								
Original	Text	Core >66%	Economy 1 *	Economy 2 *	Economy 3 *	Economy 4 *	Economy 5 *	Economy 6
1.	**Numbers**	NO					X	
2.	**Whole Numbers**	NO						
3.	Meaning	NO						
4.	Operations	NO						
5.	Properties of Operations	NO						X
6.	**Fractions & Decimals**	NO						
7.	Common Fractions	NO						
8.	Decimal Fractions	NO						
9.	Relationships of Common & Decimal Fractions	NO						
10.	Percentages	NO	X					X
11.	Properties of Common & Decimal Fractions	NO						
12.	**Integer, Rational & Real Numbers**	NO						
13.	Negative Numbers, Integers & Their Properties	NO			X		X	X
14.	Rational Numbers & Their Properties	NO	X		X			
15.	Real Numbers, Their Subsets & Properties	NO	X	X	X		X	X
16.	**Other Numbers & Number Concepts**	NO						
17.	Binary Arithmetic and/or Other Number Bases	NO						
18.	Exponents, Roots & Radicals	NO	X		X	X	X	X
19.	Real exponents	NO		X	X		X	

		Grade Spans 10-12						
Original	**Text**	**Core >66%**	**Economy 1 ***	**Economy 2 ***	**Economy 3 ***	**Economy 4 ***	**Economy 5 ***	**Economy 6**
20.	Complex Numbers & Their Properties	NO		X	X			X
21.	Number Theory	NO						X
22.	Systematic Counting	NO			X	X	X	
23.	Matrices	NO						
24.	**Estimation & Number Sense Concepts**	NO						
25.	Estimating Quantity & Size	NO					X	X
26.	Rounding & Significant Figures	NO						X
27.	Estimating Computations	NO				X		X
28.	Exponents & Orders of Magnitude	NO						
29.	**Measurement**	NO						
30.	**Measurement Units**	NO						
31.	Concept of measure (including non-standard units)	NO				X		X
32.	Standard units (including metric system)	NO						
33.	Use of appropriate instruments	NO					X	X
34.	Common measures (Length; area; volume; time; calendar; money; temp; mass; weight; angles)	NO				X		X
35.	Quotients and products of units (km/h, m/s, etc.)	NO						
36.	Dimensional analysis/ Cancellation of units	NO						

Grade Spans 10-12								
Original	**Text**	**Core >66%**	**Economy 1 ***	**Economy 2 ***	**Economy 3 ***	**Economy 4 ***	**Economy 5 ***	**Economy 6**
37.	**Computations & Properties of Length, Perimeter, Area & Volume**	**NO**				X		X
38.	Computations, formulas and properties of length and perimeter	**NO**	X		X	X	X	X
39.	Computations, formulas and properties of area	**NO**					X	X
40.	Computations, formulas and properties of surface area	**NO**				X	X	X
41.	Computations, formulas and properties of volumes	**NO**						
42.	**Estimation & Error**	**NO**						X
43.	Estimation of measurement and errors of measurement	**NO**						X
44.	Precision and accuracy of measurement	**NO**	X				X	X
45.	**Geometry: Position, Visualization & Shape**	**NO**						
46.	**1-D & 2-D Coordinate Geometry**	**YES**	X	X	X	X	X	X
47.	Line and coordinate graphs	**YES**	X	X	X	X	X	
48.	Equations of lines in a plane	**NO**	X	X	X		X	
49.	Conic sections and their equations	**NO**	X					
50.	**2-D Geometry: Basics**	**YES**	X	X		X	X	X
51.	Points, lines, segments, half-lines, and rays	**NO**	X			X		X

Grade Spans 10-12								
Original	**Text**	**Core >66%**	**Economy 1 ***	**Economy 2 ***	**Economy 3 ***	**Economy 4 ***	**Economy 5 ***	**Economy 6**
52.	Angles	NO		X	X			X
53.	Parallelism and perpendicularity	NO	X			X		
54.	**2-D Geometry: Polygons & Circles**	NO	X			X	X	X
55.	Triangles and quadrilaterals: their classification and properties	NO	X	X				X
56.	Pythagorean Theorem and its applications	NO						X
57.	Other polygons and their properties	YES	X	X		X	X	X
58.	Circles and their properties	NO						
59.	**3-D Geometry**	NO			X	X		X
60.	3-Dimensional shapes and surfaces and their properties	NO	X		X			
61.	Planes and lines in space	NO	X		X	X		X
62.	Spatial perception and visualization	NO			X			
63.	Coordinate systems in three dimensions	NO			X			
64.	Equations of lines, planes and surfaces in space	NO			X	X	X	X
65.	**Vectors**	NO						
66.	**Simple Topology**	NO	X					X
67.	**Geometry: Symmetry, Congruence & Similarity**	NO						
68.	**Geometry: Transformations**	NO						

		Grade Spans 10-12						
Original	**Text**	**Core >66%**	**Economy 1 ***	**Economy 2 ***	**Economy 3 ***	**Economy 4 ***	**Economy 5 ***	**Economy 6**
69.	Patterns, tessellations, friezes, stencils, etc	NO				X		X
70.	Symmetry	NO	X	X		X	X	X
71.	Transformations	NO						
72.	**Congruence & Similarity**	NO			X	X		X
73.	Congruence	NO				X		X
74.	Similarities (similar triangles and their properties; other similar figures and properties)	NO						
75.	**Constructions w/ Straightedge & Compass**	NO						
76.	**Proportionality**	NO						
77.	**Proportionality Concepts**	NO				X		
78.	Meaning of ratio and proportion	NO	X					
79.	Direct and inverse proportion	NO						
80.	**Proportionality Problems**	NO						X
81.	Solving proportional equations	NO	X					X
82.	Solving practical problems with proportionality	NO						X
83.	Scales (maps and plans)	NO						X
84.	Proportion based on similarity	NO						
85.	**Slope & Simple Trigonometry**	YES	X	X	X	X		X
86.	Slope and gradient in straight line graphs	YES	X	X	X	X	X	X
87.	Trigonometry of right triangles	NO			X			X
88.	**Linear Interpolation &**	NO						

		Grade Spans 10-12						
Original	Text	Core >66%	Economy 1 *	Economy 2 *	Economy 3 *	Economy 4 *	Economy 5 *	Economy 6
	Extrapolation							
89.	**Functions, Relations, & Equations**	NO						
90.	**Patterns, Relations & Functions**	NO	X					X
91.	Number patterns	NO	X					
92.	Relations and their properties	YES	X	X	X		X	X
93.	Functions and their properties	YES	X	X	X	X	X	X
94.	Representation of relations and functions	NO	X					
95.	Families of functions (graphs and properties)	NO		X			X	
96.	Operations on functions	NO	X	X			X	
97.	Related functions (inverse, derivative, etc.)	NO	X	X		X	X	X
98.	Relationship of functions and equations	YES	X	X		X	X	
99.	Interpretation of function graphs	NO						
100.	Functions of several variables	NO					X	X
101.	Recursion	NO	X			X		X
102.	Linear Functions	YES	X	X		X	X	X
103.	Quadratic Functions	NO			X	X	X	X
104.	Logarithmic and Exponential Functions	YES	X	X	X	X	X	X
105.	Trigonometric Functions	NO	X				X	
106.	**Equations & Formulas**	NO	X			X		X

		Grade Spans 10-12						
Original	Text	Core >66%	Economy 1 *	Economy 2 *	Economy 3 *	Economy 4 *	Economy 5 *	Economy 6
107.	Representation of numerical situations by equations	NO	X					
108.	Informal solution of simple equations	NO	X					
109.	Evaluating expressions	YES	X	X	X	X	X	X
110.	Equivalent expressions (including factorization and simplification)	YES	X	X		X	X	X
111.	Linear equations and their formal (closed) solutions	YES	X	X	X	X	X	X
112.	Quadratic equations and their formal (closed) solutions	NO	X	X	X	X	X	
113.	Polynomial equations and their solutions	NO		X	X		X	
114.	Trigonometrical equations and identities	NO	X					X
115.	Logarithmic and exponential equations and their solutions	NO	X			X	X	X
116.	Solution of equations reducing to quadratics, radical equations, absolute value equations, etc.	NO						
117.	Other solution methods for equations (e.g., successive approximation)	YES	X	X	X	X	X	
118.	Inequalities and/or their graphical representation	YES	X	X	X		X	X
119.	Systems of equations and their solutions (including matrix solutions)	NO	X	X				X

Grade Spans 10-12								
Original	**Text**	**Core >66%**	**Economy 1 ***	**Economy 2 ***	**Economy 3 ***	**Economy 4 ***	**Economy 5 ***	**Economy 6**
120.	Systems of inequalities	**YES**	X	X		X	X	X
121.	Substituting into or rearranging formulas	NO			X		X	
122.	General equation of the second degree and its interpretation	NO						
123.	**Trigonometry and Analytic Geometry**	NO		X	X	X	X	
124.	Angle measures: radians and degrees	NO	X	X	X	X	X	
125.	Law of sines and cosines	NO	X		X	X	X	
126.	Unit circle and trigonometric functions	NO			X		X	
127.	Parametric equations	NO					X	
128.	Polar coordinates	NO			X		X	
129.	Polar equations and their graphs	NO						
130.	**Data Representation, Probability, & Statistics**	NO	X					
131.	**Data Representation & Analysis**	NO	X		X			X
132.	Collecting data from experiments and simple surveys	**YES**	X		X	X	X	X
133.	Representing data	**YES**	X		X	X	X	X
134.	Interpreting tables, charts, plots, graphs	NO						
135.	Kinds of scales (nominal, ordinal, interval, ratio)	NO			X	X		X
136.	Measures of central tendency	**YES**	X		X	X		X

		Grade Spans 10-12						
Original	Text	Core >66%	Economy 1 *	Economy 2 *	Economy 3 *	Economy 4 *	Economy 5 *	Economy 6
137.	Measures of dispersion	NO	X					X
138.	Sampling, randomness, and bias related to data samples	NO			X		X	X
139.	Prediction and inferences from data	NO						X
140.	Fitting lines and curves to data	NO	X		X			X
141.	Correlations and other measures of relations	NO	X					X
142.	Use and misuse of statistics	NO						
143.	**Uncertainty & Probability**	NO	X		X	X		X
144.	Informal likelihoods and the vocabulary of likelihoods	YES	X	X		X	X	X
145.	Numerical probability and probability models	NO	X	X	X	X	X	
146.	Counting principles	NO				X	X	
147.	Mutually exclusive events	NO	X		X	X	X	X
148.	Conditional probability and independent events	NO			X		X	
149.	Bayes' Theorem	NO						
150.	Contingency tables	NO					X	
151.	Probability distributions for discrete random variables	NO					X	X
152.	Probability distributions for continuous random variables	NO			X			
153.	Expectation and the algebra of expectations	NO			X		X	X
154.	Sampling (distributions and	NO					X	

Grade Spans 10-12								
Original	Text	Core >66%	Economy 1 *	Economy 2 *	Economy 3 *	Economy 4 *	Economy 5 *	Economy 6
	populations)							
155.	Estimation of population parameters	NO					X	
156.	Hypothesis testing	NO			X		X	
157.	Confidence intervals	NO			X			
158.	Bivariate distributions	NO						
159.	Markov processes	NO						
160.	Monte Carlo methods and computer simulations	NO						
161.	**Elementary Analysis**	NO						
162.	**Infinite Processes**	NO	X		X		X	X
163.	Arithmetic and geometric sequences	NO	X		X		X	
164.	Arithmetic and geometric series	NO			X			
165.	Binomial Theorem	NO	X				X	X
166.	Other sequences and series	NO	X		X		X	
167.	Limits and convergence of series	NO					X	
168.	Limits and convergence of functions	NO						
169.	Continuity	NO						
170.	**Change**	NO						
171.	Growth and decay	NO					X	
172.	Differentiation	NO					X	
173.	Integration	NO						
174.	Differential equations	NO						

INDIVIDUAL ECONOMY PROFILES
MATHEMATICS

Achieve

		Grade Spans 10-12						
Original	**Text**	**Core >66%**	**Economy 1 ***	**Economy 2 ***	**Economy 3 ***	**Economy 4 ***	**Economy 5 ***	**Economy 6**
175.	Partial differentiation	NO						
176.	**Validation & Structure**	NO						
177.	**Validation & Justification**	NO	X	X				
178.	Logical connectives	NO						
179.	Quantifiers ("for all", "there exists")	NO						
180.	Boolean algebra and truth tables	NO		X			X	
181.	Conditional statements; equivalence of statements (including converse, contrapositive, and inverse)	NO					X	
182.	Inference schemes (e.g., *modus ponens*, *modus tollens*)	NO	X				X	
183.	Direct deductive proofs	NO		X			X	
184.	Indirect proofs and proof by contradiction	NO			X		X	
185.	Proof by mathematical induction	NO	X		X			
186.	Consistency and independence of axiom systems	NO						
187.	**Structuring and Abstracting**	NO		X			X	
188.	Sets, set notation, and set combinations	NO						
189.	Equivalence relations, partitions, and classes	NO						
190.	Groups	NO						
191.	Fields	NO						

		Grade Spans 10-12						
Original	Text	Core >66%	Economy 1 *	Economy 2 *	Economy 3 *	Economy 4 *	Economy 5 *	Economy 6
192.	Linear (vectors) spaces	NO						
193.	Subgroups, subspaces, etc.	NO						
194.	Other axiomatic systems	NO						
195.	Isomorphism	NO						
196.	Homomorphism	NO						
197.	**Other Content**	NO					X	
198.	**Informatics (operation of computers, flow charts, learning a programming language, programs, algorithms with applications to the computer, complexity)**	NO	X		X		X	
199.	**History and nature of mathematics**	NO					X	
200.	**Special application of mathematics (kinematics, Newtonian mechanics, population growth, networks, linear programming, critical path analysis, examples from economics)**	NO						
201.	**Problem solving heuristics**	NO						
202.	**Non-mathematical science content**	NO	X			X		
203.	**Non-mathematical content other than science**	NO						

	Grade Spans 10-12						
Original	Text	Core >66%	Economy 7	Economy 8	Economy 9	Economy 10	Economy 11
1.	**Numbers**	NO					
2.	**Whole Numbers**	NO					
3.	Meaning	NO	X				
4.	Operations	NO					
5.	Properties of Operations	NO					
6.	**Fractions & Decimals**	NO					
7.	Common Fractions	NO					
8.	Decimal Fractions	NO					X
9.	Relationships of Common & Decimal Fractions	NO					
10.	Percentages	NO					X
11.	Properties of Common & Decimal Fractions	NO					
12.	**Integer, Rational & Real Numbers**	NO					
13.	Negative Numbers, Integers & Their Properties	NO			X		
14.	Rational Numbers & Their Properties	NO		X	X		
15.	Real Numbers, Their Subsets & Properties	NO	X		X		X
16.	**Other Numbers & Number Concepts**	NO					
17.	Binary Arithmetic and/or Other Number Bases	NO					
18.	Exponents, Roots & Radicals	NO		X	X		X
19.	Real exponents	NO		X			X
20.	Complex Numbers & Their Properties	NO	X				
21.	Number Theory	NO	X	X	X		X
22.	Systematic Counting	NO	X				
23.	Matrices	NO					
24.	**Estimation & Number Sense Concepts**	NO					

Original	Text	Core >66%	Economy 7	Economy 8	Economy 9	Economy 10	Economy 11
	Grade Spans 10-12						
25.	Estimating Quantity & Size	NO	X		X		X
26.	Rounding & Significant Figures	NO			X		
27.	Estimating Computations	NO					X
28.	Exponents & Orders of Magnitude	NO		X			
29.	**Measurement**	NO					
30.	**Measurement Units**	NO					
31.	Concept of measure (including non-standard units)	NO		X			
32.	Standard units (including metric system)	NO					
33.	Use of appropriate instruments	NO					
34.	Common measures (Length; area; volume; time; calendar; money; temp; mass; weight; angles)	NO		X			
35.	Quotients and products of units (km/h, m/s, etc.)	NO					
36.	Dimensional analysis / Cancellation of Units	NO					
37.	**Computations & Properties of Length, Perimeter, Area & Volume**	NO	X	X		X	
38.	Computations, formulas and properties of length and perimeter	NO	X	X			
39.	Computations, formulas and properties of area	NO				X	
40.	Computations, formulas and properties of surface area	NO		X		X	
41.	Computations, formulas and properties of volumes	NO					
42.	**Estimation & Error**	NO		X	X		

Grade Spans 10-12							
Original	Text	Core >66%	Economy 7	Economy 8	Economy 9	Economy 10	Economy 11
43.	Estimation of measurement and errors of measurement	NO		X			
44.	Precision and accuracy of measurement	NO					
45.	**Geometry: Position, Visualization & Shape**	NO					X
46.	**1-D & 2-D Coordinate Geometry**	YES	X	X		X	X
47.	Line and coordinate graphs	YES	X	X		X	X
48.	Equations of lines in a plane	NO		X			X
49.	Conic sections and their equations	NO					
50.	**2-D Geometry: Basics**	YES	X	X		X	X
51.	Points, lines, segments, half-lines, and rays	NO	X	X		X	X
52.	Angles	NO	X			X	X
53.	Parallelism and perpendicularity	NO				X	X
54.	**2-D Geometry: Polygons & Circles**	NO		X		X	X
55.	Triangles and quadrilaterals: their classification and properties	NO		X		X	X
56.	Pythagorean Theorem and its applications	NO		X			X
57.	Other polygons and their properties	YES	X	X		X	X
58.	Circles and their properties	NO					
59.	**3-D Geometry**	NO	X	X		X	
60.	3-Dimensional shapes and surfaces and their properties	NO	X			X	
61.	Planes and lines in space	NO	X			X	
62.	Spatial perception and visualization	NO	X			X	
63.	Coordinate systems in three dimensions	NO					
64.	Equations of lines, planes and surfaces in space	NO				X	
65.	**Vectors**	NO					

Grade Spans 10-12							
Original	Text	Core >66%	Economy 7	Economy 8	Economy 9	Economy 10	Economy 11
66.	**Simple Topology**	NO					
67.	**Geometry: Symmetry, Congruence & Similarity**	NO					
68.	**Geometry: Transformations**	NO					
69.	Patterns, tessellations, friezes, stencils, etc	NO		X			X
70.	Symmetry	NO	X	X			
71.	Transformations	NO					
72.	**Congruence & Similarity**	NO	X				
73.	Congruence	NO	X	X			
74.	Similarities (similar triangles and their properties; other similar figures and properties)	NO	X				
75.	**Constructions w/ Straightedge & Compass**	NO					
76.	**Proportionality**	NO					
77.	**Proportionality Concepts**	NO	X			X	
78.	Meaning of ratio and proportion	NO	X	X			X
79.	Direct and inverse proportion	NO					
80.	**Proportionality Problems**	NO	X	X			
81.	Solving proportional equations	NO		X			
82.	Solving practical problems with proportionality	NO	X	X			
83.	Scales (maps and plans)	NO		X			
84.	Proportion based on similarity	NO					
85.	**Slope & Simple Trigonometry**	YES	X	X		X	X
86.	Slope and gradient in straight line graphs	YES	X	X	X	X	X
87.	Trigonometry of right triangles	NO		X			
88.	**Linear Interpolation & Extrapolation**	NO					

			Grade Spans 10-12				
Original	**Text**	**Core >66%**	**Economy 7**	**Economy 8**	**Economy 9**	**Economy 10**	**Economy 11**
89.	**Functions, Relations, & Equations**	NO					
90.	**Patterns, Relations & Functions**	NO	X		X	X	X
91.	Number patterns	NO			X		X
92.	Relations and their properties	YES	X	X	X	X	X
93.	Functions and their properties	YES	X	X	X	X	X
94.	Representation of relations and functions	NO	X	X		X	X
95.	Families of functions (graphs and properties)	NO					X
96.	Operations on functions	NO	X	X			X
97.	Related functions (inverse, derivative, etc.)	NO	X	X			X
98.	Relationship of functions and equations	YES	X	X	X	X	X
99.	Interpretation of function graphs	NO					
100.	Functions of several variables	NO		X			X
101.	Recursion	NO	X	X		X	X
102.	Linear Functions	YES	X	X		X	X
103.	Quadratic Functions	NO		X		X	X
104.	Logarithmic and Exponential Functions	YES	X	X		X	X
105.	Trigonometric Functions	NO	X				
106.	**Equations & Formulas**	NO	X				X
107.	Representation of numerical situations by equations	NO					
108.	Informal solution of simple equations	NO	X				X
109.	Evaluating expressions	YES	X	X			X
110.	Equivalent expressions (including factorization and simplification)	YES	X	X	X	X	X
111.	Linear equations and their formal (closed) solutions	YES	X	X	X	X	X

			Grade Spans 10-12				
Original	**Text**	**Core >66%**	**Economy 7**	**Economy 8**	**Economy 9**	**Economy 10**	**Economy 11**
112.	Quadratic equations and their formal (closed) solutions	NO	X	X			X
113.	Polynomial equations and their solutions	NO		X		X	X
114.	Trigonometrical equations and identities	NO		X		X	X
115.	Logarithmic and exponential equations and their solutions	NO	X	X			X
116.	Solution of equations reducing to quadratics, radical equations, absolute value equations, etc.	NO		X		X	
117.	Other solution methods for equations (e.g., successive approximation)	YES	X		X	X	X
118.	Inequalities and/or their graphical representation	YES	X	X		X	X
119.	Systems of equations and their solutions (including matrix solutions)	NO	X			X	X
120.	Systems of inequalities	YES	X	X		X	
121.	Substituting into or rearranging formulas	NO		X		X	X
122.	General equation of the second degree and its interpretation	NO					
123.	**Trigonometry and Analytic Geometry**	NO	X			X	X
124.	Angle measures: radians and degrees	NO		X			X
125.	Law of sines and cosines	NO	X			X	X
126.	Unit circle and trigonometric functions	NO					
127.	Parametric equations	NO					
128.	Polar coordinates	NO					
129.	Polar equations and their graphs	NO					
130.	**Data Representation, Probability, & Statistics**	NO	X	X			
131.	**Data Representation & Analysis**	NO		X		X	X

			Grade Spans 10-12					
Original	Text	Core >66%	Economy 7	Economy 8	Economy 9	Economy 10	Economy 11
132.	Collecting data from experiments and simple surveys	YES	X		X	X	X
133.	Representing data	YES	X	X	X		X
134.	Interpreting tables, charts, plots, graphs	NO	X				
135.	Kinds of scales (nominal, ordinal, interval, ratio)	NO	X	X	X	X	
136.	Measures of central tendency	YES	X	X	X	X	X
137.	Measures of dispersion	NO		X	X	X	X
138.	Sampling, randomness, and bias related to data samples	NO		X	X	X	X
139.	Prediction and inferences from data	NO		X		X	
140.	Fitting lines and curves to data	NO		X		X	
141.	Correlations and other measures of relations	NO		X		X	
142.	Use and misuse of statistics	NO	X				
143.	**Uncertainty & Probability**	NO	X		X	X	
144.	Informal likelihoods and the vocabulary of likelihoods	YES	X	X	X	X	
145.	Numerical probability and probability models	NO		X		X	X
146.	Counting principles	NO				X	
147.	Mutually exclusive events	NO					
148.	Conditional probability and independent events	NO		X			
149.	Bayes' Theorem	NO		X			
150.	Contingency tables	NO		X		X	X
151.	Probability distributions for discrete random variables	NO		X			X
152.	Probability distributions for continuous random variables	NO					

Grade Spans 10-12							
Original	Text	Core >66%	Economy 7	Economy 8	Economy 9	Economy 10	Economy 11
153.	Expectation and the algebra of expectations	NO		X		X	
154.	Sampling (distributions and populations)	NO		X		X	
155.	Estimation of population parameters	NO					
156.	Hypothesis testing	NO		X			
157.	Confidence intervals	NO					
158.	Bivariate distributions	NO		X			
159.	Markov processes	NO					
160.	Monte Carlo methods and computer simulations	NO					
161.	**Elementary Analysis**	NO					
162.	**Infinite Processes**	NO		X	X	X	X
163.	Arithmetic and geometric sequences	NO		X	X		X
164.	Arithmetic and geometric series	NO					X
165.	Binomial Theorem	NO					
166.	Other sequences and series	NO					
167.	Limits and convergence of series	NO		X			
168.	Limits and convergence of functions	NO		X			
169.	Continuity	NO					
170.	**Change**	NO					X
171.	Growth and decay	NO		X			
172.	Differentiation	NO		X			
173.	Integration	NO		X			
174.	Differential equations	NO					
175.	Partial differentiation	NO	X				
176.	**Validation & Structure**	NO					
177.	**Validation & Justification**	NO	X				X

			Grade Spans 10-12				
Original	**Text**	**Core >66%**	**Economy 7**	**Economy 8**	**Economy 9**	**Economy 10**	**Economy 11**
178.	Logical connectives	NO	X				
179.	Quantifiers ("for all", "there exists")	NO	X				
180.	Boolean algebra and truth tables	NO	X				X
181.	Conditional statements; equivalence of statements (including converse, contrapositive, and inverse)	NO	X				
182.	Inference schemes (e.g., *modus ponens*, *modus tollens*)	NO			X		X
183.	Direct deductive proofs	NO					
184.	Indirect proofs and proof by contradiction	NO					
185.	Proof by mathematical induction	NO					
186.	Consistency and independence of axiom systems	NO					
187.	**Structuring and Abstracting**	NO	X		X	X	
188.	Sets, set notation, and set combinations	NO				X	
189.	Equivalence relations, partitions, and classes	NO					
190.	Groups	NO					
191.	Fields	NO					
192.	Linear (vectors) spaces	NO				X	
193.	Subgroups, subspaces, etc.	NO					
194.	Other axiomatic systems	NO					
195.	Isomorphism	NO					
196.	Homomorphism	NO					
197.	**Other Content**	NO				X	X

	Grade Spans 10-12						
Original	**Text**	**Core >66%**	**Economy 7**	**Economy 8**	**Economy 9**	**Economy 10**	**Economy 11**
198.	**Informatics (operation of computers, flow charts, learning a programming language, programs, algorithms with applications to the computer, complexity)**	**NO**				**X**	
199.	**History and nature of mathematics**	**NO**		**X**		**X**	**X**
200.	**Special application of mathematics (kinematics, Newtonian mechanics, population growth, networks, linear programming, critical path analysis, examples from economics)**	**NO**					
201.	**Problem solving heuristics**	**NO**					**X**
202.	**Non-mathematical science content**	**NO**	**X**				
203.	**Non-mathematical content other than science**	**NO**					

APPENDIX E (CONTINUED): INDIVIDUAL ECONOMY PORTRAITS
SCIENCE

The following individual economy profiles show the specific topics addressed by each economy's standards in the corresponding grade spans. The third column, labeled "Core," denotes with the word "YES" the topics included in the set of common topics. Those topics not included in the set of common topics are denoted with the word "NO". Five economies marked with an asterisk (*) are examples of high performing economies on PISA and TIMSS.

Grade Spans 1-4							
Number	**Text**	**Core >66%**	**Economy 1***	**Economy 2***	**Economy 3***	**Economy 4***	**Economy 5***
1	**Earth Sciences**	NO					
2	**Earth Features**	NO	X		X		
3	Earth's composition	NO		X			
4	Landforms	NO		X			
5	Bodies of water	NO		X	X		
6	Atmosphere	NO		X	X		
7	Rocks, soil	NO		X	X		
8	Ice forms	NO					
9	**Earth Processes**	NO		X			
10	Weather & climate	YES	X	X	X		X
11	Physical & Chemical Cycles	NO		X			X
12	Constructive and Destructive Processes	NO		X	X		
13	Earth's history	NO		X	X		
14	**Earth and the Universe**	NO					
15	Earth, sun, moon	NO			X		X
16	Planets in the solar system	NO			X		
17	Beyond the solar system	NO			X		X
18	Evolution of the universe	NO					
19	Motion/location of celestial bodies	NO	X		X		X

		Grade Spans 1-4					
Number	**Text**	**Core >66%**	**Economy 1***	**Economy 2***	**Economy 3***	**Economy 4***	**Economy 5***
20	**Life Sciences**	NO					
21	**Diversity, Organization and Structure of Living Things**	NO		X	X		
22	Plants	YES	X	X		X	X
23	Animals	YES	X	X	X	X	X
24	Other organisms	NO	X			X	
25	Systems, organs, tissues	NO	X	X	X	X	
26	Cells	NO			X	X	
27	**Life Processes and Systems Enabling Life Functions**	NO	X				
28	Energy handling, biochemistry of systems	NO				X	
29	Sensing and responding	NO			X		
30	Biochemical processes in cells	NO					
31	**Life Spirals, Genetic Continuity and Diversity**	NO					
32	Life cycles	YES		X	X	X	X
33	Reproduction	NO			X		
34	Variation and inheritance	NO			X		
35	Population genetics, biotechnology	NO					
36	Evolution, speciation, diversity	NO					
37	Biochemistry of genetics	NO					
38	Genetic engineering	NO					
39	**Interactions of Living Things**	NO		X			

		Grade Spans 1-4					
Number	**Text**	**Core >66%**	**Economy 1***	**Economy 2***	**Economy 3***	**Economy 4***	**Economy 5***
40	Biomes & ecosystems	NO	X		X		
41	Habitats & niches	NO		X	X		X
42	Interdependence of life	NO					X
43	Food webs, adaptations to habitats	NO					
44	Competition among organisms	NO			X		
45	Animal behavior	NO			X		X
46	Needs of living things	NO		X		X	
47	**Human Biology and Health**	**YES**	X	X	X	X	X
48	Human Nutrition	NO	X		X		
49	Human Disease and health	NO					
50	**Physical Sciences**	NO					
51	**Matter**	NO	X		X		
52	Classification of matter	**YES**		X	X	X	X
53	Physical properties	**YES**	X	X	X	X	X
54	Chemical properties	**YES**	X	X	X		X
55	Acids, Bases, Salts	NO			X		
56	**Structure of Matter**	NO			X		
57	Atoms, ions, molecules	NO			X		
58	Formulas/Equations/Nomenclature, Stoichiometry	NO					
59	Macromolecules	NO			X		

		Grade Spans 1-4					
Number	**Text**	**Core >66%**	**Economy 1***	**Economy 2***	**Economy 3***	**Economy 4***	**Economy 5***
60	Subatomic particles	NO			X		
61	**Energy and Physical Processes**	NO					
62	Energy types, conversions, sources	NO	X		X	X	
63	Work, Power, Simple machines	NO					
64	Heat and temperature	YES	X	X	X	X	X
65	Wave phenomena	NO					
66	Sound & vibration	NO			X		
67	Light	YES		X	X	X	X
68	Electricity	NO			X		X
69	Magnetism/electromagnetism	YES		X		X	X
70	**Physical Transformations**	NO					
71	Physical changes	YES	X		X		X
72	Explanations of physical changes	NO		X	X		X
73	Kinetic-molecular theory	NO			X		
74	Quantum theory & fundamental particles	NO					
75	**Chemical Transformations**	NO					
76	Chemical changes	NO	X				
77	Definition & evidence of chemical change	NO					
78	Types of reactions	NO					

Grade Spans 1-4							
Number	**Text**	**Core >66%**	**Economy 1***	**Economy 2***	**Economy 3***	**Economy 4***	**Economy 5***
79	Law of Conservation of Matter	NO					
80	Explanations of chemical changes	NO					
81	Determinants/trends of chemical reactivity	NO					
82	Rate of change and equilibria	NO			X		
83	Energy and chemical change	NO					
84	Calorimetry, exothermic/endothermic reactions	NO					
85	First law of thermodynamics	NO					
86	Second law of thermodynamics	NO					
87	Organic & biochemical changes	NO					
88	Nuclear chemistry	NO					
89	Electrochemistry	NO			X		
90	**Forces and Motion**	NO					
91	Types of forces	NO					X
92	Contact forces and forces acting at a distance	NO		X			
93	Pressure - force applied to a surface	NO			X		
94	Time, space and motion	NO		X	X		
95	Measurement of time/space/mass	NO		X			
96	Types of motion/describing motion	NO					
97	Frames of reference	NO					

INDIVIDUAL ECONOMY PROFILES
SCIENCE

		Grade Spans 1-4					
Number	**Text**	**Core >66%**	**Economy 1***	**Economy 2***	**Economy 3***	**Economy 4***	**Economy 5***
98	Dynamics of motion	NO	X	X	X		
99	Relativity theory	NO					
100	Air/fluid behavior	NO		X	X		X
101	**Science, Technology and Mathematics**	NO			X		
102	Nature or Conceptions of Technology	NO	X	X	X	X	
103	Interactions of Science, Mathematics, & Technology	NO	X				
104	Mathematics, technology influence on science	NO					
105	Science applications in mathematics, technology	NO	X				
106	Interactions of Science, Technology and Society	NO	X		X		
107	Influence of science, technology on society	NO					
108	Influence of society on science, technology	NO					
109	**History of Science and Technology**	NO			X		
110	**Environmental and Resource Issues Related to Science**	NO	X		X		
111	Pollution - Causes and Treatment	NO	X		X		
112	Land, Water, Sea Resource Conservation	YES	X	X	X		
113	Material & Energy Resource Conservation	NO	X		X		
114	World Population	NO					
115	Food Production, Storage	NO			X		
116	Effects of Natural Disasters	NO			X		

Grade Spans 1-4							
Number	**Text**	**Core >66%**	**Economy 1***	**Economy 2***	**Economy 3***	**Economy 4***	**Economy 5***
117	**Nature of Science**	NO					
118	Nature of Scientific Knowledge	NO	X			X	X
119	The Scientific Enterprise	NO					X
120	**Science and Other Disciplines**	NO					
121	Science & Mathematics	NO					
122	Science and Other Disciplines	NO					

Grade Spans 1-4							
Number	**Text**	**Core >66%**	**Economy 6**	**Economy 7**	**Economy 8**	**Economy 9**	**Economy 10**
1	**Earth Sciences**	NO					
2	**Earth Features**	NO	X			X	
3	Earth's composition	NO		X			
4	Landforms	NO					
5	Bodies of water	NO		X		X	
6	Atmosphere	NO		X			
7	Rocks, soil	NO		X	X	X	
8	Ice forms	NO					
9	**Earth Processes**	NO					
10	Weather & climate	YES	X	X	X	X	

Grade Spans 1-4							
Number	**Text**	**Core >66%**	**Economy 6**	**Economy 7**	**Economy 8**	**Economy 9**	**Economy 10**
11	Physical & Chemical Cycles	NO		X			
12	Constructive and Destructive Processes	NO		X		X	
13	Earth's history	NO	X		X		
14	**Earth and the Universe**	NO				X	
15	Earth, sun, moon	NO	X	X	X	X	
16	Planets in the solar system	NO			X		
17	Beyond the solar system	NO					
18	Evolution of the universe	NO					
19	Motion/location of celestial bodies	NO		X			
20	**Life Sciences**	NO					
21	**Diversity, Organization and Structure of Living Things**	NO	X		X	X	X
22	Plants	YES	X		X	X	
23	Animals	YES	X		X	X	
24	Other organisms	NO	X			X	
25	Systems, organs, tissues	NO			X	X	
26	Cells	NO					
27	**Life Processes and Systems Enabling Life Functions**	NO		X	X	X	X
28	Energy handling, biochemistry of systems	NO	X	X	X	X	
29	Sensing and responding	NO			X	X	

Grade Spans 1-4							
Number	**Text**	**Core >66%**	**Economy 6**	**Economy 7**	**Economy 8**	**Economy 9**	**Economy 10**
30	Biochemical processes in cells	NO					
31	**Life Spirals, Genetic Continuity and Diversity**	NO					X
32	Life cycles	YES		X	X	X	
33	Reproduction	NO		X	X	X	
34	Variation and inheritance	NO			X	X	
35	Population genetics, biotechnology	NO					
36	Evolution, speciation, diversity	NO	X	X			
37	Biochemistry of genetics	NO					
38	Genetic engineering	NO					
39	**Interactions of Living Things**	NO				X	
40	Biomes & ecosystems	NO	X		X	X	X
41	Habitats & niches	NO	X		X	X	X
42	Interdependence of life	NO	X	X	X	X	X
43	Food webs, adaptations to habitats	NO	X	X			
44	Competition among organisms	NO					
45	Animal behavior	NO			X	X	
46	Needs of living things	NO	X	X	X	X	
47	**Human Biology and Health**	YES	X		X	X	
48	Human Nutrition	NO			X	X	
49	Human Disease and health	NO			X	X	
50	**Physical Sciences**	NO					

		Grade Spans 1-4					
Number	**Text**	**Core >66%**	**Economy 6**	**Economy 7**	**Economy 8**	**Economy 9**	**Economy 10**
51	**Matter**	NO					
52	Classification of matter	YES	X	X	X	X	X
53	Physical properties	YES	X	X	X	X	X
54	Chemical properties	YES	X	X	X	X	X
55	Acids, Bases, Salts	NO					
56	**Structure of Matter**	NO					
57	Atoms, ions, molecules	NO					
58	Formulas/Equations/Nomenclature, Stoichiometry	NO					
59	Macromolecules	NO					
60	Subatomic particles	NO					
61	**Energy and Physical Processes**	NO	X				X
62	Energy types, conversions, sources	NO		X	X		
63	Work, Power, Simple machines	NO					
64	Heat and temperature	YES	X	X	X	X	
65	Wave phenomena	NO	X				
66	Sound & vibration	NO	X	X	X	X	
67	Light	YES	X	X	X	X	
68	Electricity	NO	X	X	X	X	
69	Magnetism/electromagnetism	YES	X	X	X	X	
70	**Physical Transformations**	NO	X				X

Grade Spans 1-4							
Number	**Text**	**Core >66%**	**Economy 6**	**Economy 7**	**Economy 8**	**Economy 9**	**Economy 10**
71	Physical changes	**YES**	X	X	X	X	
72	Explanations of physical changes	**NO**			X	X	
73	Kinetic-molecular theory	**NO**			X		
74	Quantum theory & fundamental particles	**NO**					
75	**Chemical Transformations**	**NO**			X		X
76	Chemical changes	**NO**	X			X	
77	Definition & evidence of chemical change	**NO**			X		
78	Types of reactions	**NO**			X		
79	Law of Conservation of Matter	**NO**					
80	Explanations of chemical changes	**NO**					
81	Determinants/trends of chemical reactivity	**NO**					
82	Rate of change and equilibria	**NO**					
83	Energy and chemical change	**NO**					
84	Calorimetry, exothermic/endothermic reactions	**NO**					
85	First law of thermodynamics	**NO**					
86	Second law of thermodynamics	**NO**					
87	Organic & biochemical changes	**NO**					
88	Nuclear chemistry	**NO**					

Grade Spans 1-4							
Number	**Text**	**Core >66%**	**Economy 6**	**Economy 7**	**Economy 8**	**Economy 9**	**Economy 10**
89	Electrochemistry	NO			X		
90	**Forces and Motion**	NO	X				X
91	Types of forces	NO	X	X		X	
92	Contact forces and forces acting at a distance	NO		X			
93	Pressure - force applied to a surface	NO					
94	Time, space and motion	NO	X	X	X		
95	Measurement of time/space/mass	NO			X		
96	Types of motion/describing motion	NO				X	
97	Frames of reference	NO				X	
98	Dynamics of motion	NO		X	X	X	
99	Relativity theory	NO					
100	Air/fluid behavior	NO					
101	**Science, Technology and Mathematics**	NO					
102	Nature or Conceptions of Technology	NO			X	X	
103	Interactions of Science, Mathematics, & Technology	NO				X	
104	Mathematics, technology influence on science	NO		X			
105	Science applications in mathematics, technology	NO	X	X		X	
106	Interactions of Science, Technology and Society	NO				X	
107	Influence of science, technology on society	NO		X	X	X	X

Grade Spans 1-4		Core >66%	Economy 6	Economy 7	Economy 8	Economy 9	Economy 10
Number	**Text**						
108	Influence of society on science, technology	NO			X	X	X
109	**History of Science and Technology**	NO			X	X	
110	**Environmental and Resource Issues Related to Science**	NO	X			X	
111	Pollution - Causes and Treatment	NO		X			X
112	Land, Water, Sea Resource Conservation	YES	X	X	X	X	X
113	Material & Energy Resource Conservation	NO	X	X	X	X	X
114	World Population	NO		X			X
115	Food Production, Storage	NO		X		X	X
116	Effects of Natural Disasters	NO	X	X			
117	**Nature of Science**	NO					
118	Nature of Scientific Knowledge	NO	X			X	X
119	The Scientific Enterprise	NO	X			X	
120	**Science and Other Disciplines**	NO					
121	Science & Mathematics	NO			X		
122	Science and Other Disciplines	NO					

		Grade Spans 5-6					
Number	**Text**	**Core >66%**	**Economy 1***	**Economy 2***	**Economy 3***	**Economy 4***	**Economy 5***
1	**Earth Sciences**	NO					
2	**Earth Features**	NO			X		X
3	Earth's composition	NO			X		
4	Landforms	NO			X		
5	Bodies of water	NO			X		X
6	Atmosphere	NO		X	X	X	
7	Rocks, soil	NO			X		X
8	Ice forms	NO					
9	**Earth Processes**	NO					X
10	Weather & climate	YES	X	X	X		X
11	Physical & Chemical Cycles	YES		X	X	X	
12	Constructive and Destructive Processes	NO					X
13	Earth's history	NO					X
14	**Earth and the Universe**	NO	X		X		
15	Earth, sun, moon	YES	X	X	X	X	X
16	Planets in the solar system	NO		X			
17	Beyond the solar system	NO			X		
18	Evolution of the universe	NO		X			
19	Motion/location of celestial bodies	NO		X			
20	**Life Sciences**	NO					

		Grade Spans 5-6					
Number	**Text**	**Core >66%**	**Economy 1***	**Economy 2***	**Economy 3***	**Economy 4***	**Economy 5***
21	**Diversity, Organization and Structure of Living Things**	NO	X		X		X
22	Plants	YES	X	X		X	X
23	Animals	NO	X				X
24	Other organisms	NO	X	X			
25	Systems, organs, tissues	YES	X	X	X	X	X
26	Cells	NO		X		X	
27	**Life Processes and Systems Enabling Life Functions**	NO	X				X
28	Energy handling, biochemistry of systems	NO		X	X	X	X
29	Sensing and responding	NO		X	X	X	
30	Biochemical processes in cells	NO		X	X		
31	**Life Spirals, Genetic Continuity and Diversity**	NO					
32	Life cycles	NO	X			X	X
33	Reproduction	NO			X	X	X
34	Variation and inheritance	NO				X	
35	Population genetics, biotechnology	NO					
36	Evolution, speciation, diversity	NO				X	
37	Biochemistry of genetics	NO					
38	Genetic engineering	NO					
39	**Interactions of Living Things**	NO			X		X
40	Biomes & ecosystems	NO	X	X	X	X	

Grade Spans 5-6							
Number	**Text**	**Core >66%**	**Economy 1***	**Economy 2***	**Economy 3***	**Economy 4***	**Economy 5***
41	Habitats & niches	YES		X	X	X	X
42	Interdependence of life	NO	X			X	
43	Food webs, adaptations to habitats	NO			X	X	X
44	Competition among organisms	NO		X	X	X	X
45	Animal behavior	NO			X	X	
46	Needs of living things	YES	X	X	X	X	X
47	**Human Biology and Health**	YES	X	X	X	X	X
48	Human Nutrition	NO	X	X	X		
49	Human Disease and health	NO		X			
50	**Physical Sciences**	NO					
51	**Matter**	NO					
52	Classification of matter	YES	X	X	X		X
53	Physical properties	NO			X	X	
54	Chemical properties	NO		X	X		
55	Acids, Bases, Salts	NO		X			
56	**Structure of Matter**	NO					
57	Atoms, ions, molecules	NO			X		
58	Formulas/Equations/Nomenclature, Stoichiometry	NO					
59	Macromolecules	NO			X		
60	Subatomic particles	NO			X		

Grade Spans 5-6							
Number	**Text**	**Core >66%**	**Economy 1***	**Economy 2***	**Economy 3***	**Economy 4***	**Economy 5***
61	**Energy and Physical Processes**	NO					
62	Energy types, conversions, sources	NO	X	X		X	
63	Work, Power, Simple machines	YES	X	X		X	X
64	Heat and temperature	YES		X	X	X	X
65	Wave phenomena	NO			X		
66	Sound & vibration	NO	X				
67	Light	NO	X	X	X		
68	Electricity	YES	X	X	X	X	X
69	Magnetism/electromagnetism	NO		X	X		X
70	**Physical Transformations**	NO					
71	Physical changes	YES	X	X	X	X	X
72	Explanations of physical changes	YES		X	X	X	X
73	Kinetic-molecular theory	NO					
74	Quantum theory & fundamental particles	NO					
75	**Chemical Transformations**	NO					
76	Chemical changes	NO	X		X		X
77	Definition & evidence of chemical change	NO		X	X		
78	Types of reactions	NO		X	X		X
79	Law of Conservation of Matter	NO		X	X		X
80	Explanations of chemical changes	NO					
81	Determinants/trends of chemical reactivity	NO					

INDIVIDUAL ECONOMY PROFILES
SCIENCE

		Grade Spans 5-6					
Number	**Text**	**Core >66%**	**Economy 1***	**Economy 2***	**Economy 3***	**Economy 4***	**Economy 5***
82	Rate of change and equilibria	NO		X	X		
83	Energy and chemical change	NO					
84	Calorimetry, exothermic/endothermic reactions	NO			X		
85	First law of thermodynamics	NO			X		
86	Second law of thermodynamics	NO					
87	Organic & biochemical changes	NO			X		
88	Nuclear chemistry	NO					
89	Electrochemistry	NO				X	
90	**Forces and Motion**	NO					
91	Types of forces	NO				X	
92	Contact forces and forces acting at a distance	NO			X	X	
93	Pressure - force applied to a surface	NO			X		
94	Time, space and motion	YES			X	X	X
95	Measurement of time/space/mass	NO		X			
96	Types of motion/describing motion	NO		X			
97	Frames of reference	NO			X		
98	Dynamics of motion	YES	X	X	X	X	X
99	Relativity theory	NO					
100	Air/fluid behavior	NO			X		
101	**Science, Technology and Mathematics**	NO					

Grade Spans 5-6							
Number	**Text**	**Core >66%**	**Economy 1***	**Economy 2***	**Economy 3***	**Economy 4***	**Economy 5***
102	Nature or Conceptions of Technology	**YES**	X	X	X	X	
103	Interactions of Science, Mathematics, & Technology	NO					
104	Mathematics, technology influence on science	NO					
105	Science applications in mathematics, technology	NO	X				
106	Interactions of Science, Technology and Society	NO	X		X		
107	Influence of science, technology on society	NO	X			X	
108	Influence of society on science, technology	NO	X				
109	**History of Science and Technology**	NO			X		
110	**Environmental and Resource Issues Related to Science**	NO		X			
111	Pollution - Causes and Treatment	NO	X	X	X	X	
112	Land, Water, Sea Resource Conservation	NO	X		X		
113	Material & Energy Resource Conservation	YES	X	X	X		
114	World Population	NO					
115	Food Production, Storage	NO					
116	Effects of Natural Disasters	NO			X		
117	**Nature of Science**	NO					
118	Nature of Scientific Knowledge	NO	X		X	X	
119	The Scientific Enterprise	NO	X		X		

Grade Spans 5-6							
Number	**Text**	**Core >66%**	**Economy 1***	**Economy 2***	**Economy 3***	**Economy 4***	**Economy 5***
120	**Science and Other Disciplines**	NO					
121	Science & Mathematics	NO					
122	Science and Other Disciplines	NO					

Grade Spans 5-6						
Number	**Text**	**YES (>66%)**	**Economy 6**	**Economy 7**	**Economy 8**	**Economy 9**
1	**Earth Sciences**	NO				
2	**Earth Features**	NO	X		X	X
3	Earth's composition	NO				
4	Landforms	NO				
5	Bodies of water	NO	X			
6	Atmosphere	NO	X			
7	Rocks, soil	NO	X		X	
8	Ice forms	NO	X			
9	**Earth Processes**	NO			X	X
10	Weather & climate	YES	X	X	X	
11	Physical & Chemical Cycles	YES	X	X	X	
12	Constructive and Destructive Processes	NO			X	
13	Earth's history	NO	X	X	X	
14	**Earth and the Universe**	NO				X

		Grade Spans 5-6				
Number	**Text**	**YES (>66%)**	**Economy 6**	**Economy 7**	**Economy 8**	**Economy 9**
15	Earth, sun, moon	**YES**		X	X	
16	Planets in the solar system	NO	X		X	
17	Beyond the solar system	NO				
18	Evolution of the universe	NO				
19	Motion/location of celestial bodies	NO		X	X	
20	**Life Sciences**	NO				
21	**Diversity, Organization and Structure of Living Things**	**NO**	X		X	X
22	Plants	**YES**	X	X		
23	Animals	NO	X	X	X	
24	Other organisms	NO	X	X	X	
25	Systems, organs, tissues	**YES**			X	
26	Cells	NO				
27	**Life Processes and Systems Enabling Life Functions**	NO	X	X		
28	Energy handling, biochemistry of systems	NO			X	
29	Sensing and responding	NO	X		X	
30	Biochemical processes in cells	NO				
31	**Life Spirals, Genetic Continuity and Diversity**	NO		X		
32	Life cycles	**NO**		X	X	X
33	Reproduction	NO				
34	Variation and inheritance	NO				

Grade Spans 5-6					
Number	Text	YES (>66%)	Economy 6	Economy 7	Economy 8	Economy 9
35	Population genetics, biotechnology	NO				
36	Evolution, speciation, diversity	NO	X	X	X	
37	Biochemistry of genetics	NO				
38	Genetic engineering	NO				
39	**Interactions of Living Things**	NO			X	X
40	Biomes & ecosystems	NO			X	
41	Habitats & niches	YES	X	X		
42	Interdependence of life	NO		X		
43	Food webs, adaptations to habitats	NO		X		
44	Competition among organisms	NO		X		
45	Animal behavior	NO		X		
46	Needs of living things	YES		X	X	
47	**Human Biology and Health**	YES	X	X	X	
48	Human Nutrition	NO		X	X	
49	Human Disease and health	NO		X	X	
50	**Physical Sciences**	NO				
51	**Matter**	NO			X	
52	Classification of matter	YES	X	X	X	
53	Physical properties	NO	X	X	X	X
54	Chemical properties	NO	X		X	X
55	Acids, Bases, Salts	NO		X		

Grade Spans 5-6						
Number	**Text**	**YES (>66%)**	**Economy 6**	**Economy 7**	**Economy 8**	**Economy 9**
56	**Structure of Matter**	NO	X			
57	Atoms, ions, molecules	NO				
58	Formulas/Equations/Nomenclature, Stoichiometry	NO				
59	Macromolecules	NO				
60	Subatomic particles	NO				
61	**Energy and Physical Processes**	NO		X	X	
62	Energy types, conversions, sources	NO		X	X	X
63	Work, Power, Simple machines	YES		X	X	
64	Heat and temperature	YES	X	X	X	X
65	Wave phenomena	NO	X			
66	Sound & vibration	NO	X		X	
67	Light	NO	X	X		
68	Electricity	YES	X	X	X	
69	Magnetism/electromagnetism	NO	X		X	
70	**Physical Transformations**	NO				
71	Physical changes	YES			X	X
72	Explanations of physical changes	YES		X	X	
73	Kinetic-molecular theory	NO				
74	Quantum theory & fundamental particles	NO				
75	**Chemical Transformations**	NO				
76	Chemical changes	NO			X	X

Grade Spans 5-6						
Number	**Text**	**YES (>66%)**	**Economy 6**	**Economy 7**	**Economy 8**	**Economy 9**
77	Definition & evidence of chemical change	NO				
78	Types of reactions	NO			X	
79	Law of Conservation of Matter	NO			X	
80	Explanations of chemical changes	NO				
81	Determinants/trends of chemical reactivity	NO				
82	Rate of change and equilibria	NO				
83	Energy and chemical change	NO				
84	Calorimetry, exothermic/endothermic reactions	NO				
85	First law of thermodynamics	NO				
86	Second law of thermodynamics	NO				
87	Organic & biochemical changes	NO				
88	Nuclear chemistry	NO				
89	Electrochemistry	NO				
90	**Forces and Motion**	NO		X	X	X
91	Types of forces	NO	X		X	
92	Contact forces and forces acting at a distance	NO		X	X	
93	Pressure - force applied to a surface	NO				
94	Time, space and motion	YES	X	X	X	
95	Measurement of time/space/mass	NO				
96	Types of motion/describing motion	NO		X	X	
97	Frames of reference	NO				

	Grade Spans 5-6					
Number	**Text**	**YES (>66%)**	**Economy 6**	**Economy 7**	**Economy 8**	**Economy 9**
98	Dynamics of motion	YES	X	X	X	
99	Relativity theory	NO				
100	Air/fluid behavior	NO			X	
101	**Science, Technology and Mathematics**	NO				
102	Nature or Conceptions of Technology	YES	X	X	X	
103	Interactions of Science, Mathematics, & Technology	NO			X	
104	Mathematics, technology influence on science	NO				
105	Science applications in mathematics, technology	NO	X	X	X	
106	Interactions of Science, Technology and Society	NO			X	X
107	Influence of science, technology on society	NO			X	X
108	Influence of society on science, technology	NO			X	
109	**History of Science and Technology**	NO			X	
110	**Environmental and Resource Issues Related to Science**	NO	X	X	X	
111	Pollution - Causes and Treatment	NO		X		X
112	Land, Water, Sea Resource Conservation	NO	X	X		X
113	Material & Energy Resource Conservation	YES	X	X	X	X
114	World Population	NO				X
115	Food Production, Storage	NO	X	X	X	X

	Grade Spans 5-6					
Number	**Text**	**YES (>66%)**	**Economy 6**	**Economy 7**	**Economy 8**	**Economy 9**
116	Effects of Natural Disasters	NO				
117	**Nature of Science**	NO				
118	Nature of Scientific Knowledge	NO	X		X	
119	The Scientific Enterprise	NO	X		X	
120	**Science and Other Disciplines**	NO				
121	Science & Mathematics	NO		X		
122	Science and Other Disciplines	NO				

Grade Spans 7-10							
Number	**Text**	**Core >66%**	**Economy 1***	**Economy 2***	**Economy 3***	**Economy 4***	**Economy 5***
1	**Earth Sciences**	NO					
2	**Earth Features**	NO	X	X	X		X
3	Earth's composition	NO		X	X		X
4	Landforms	NO		X	X		
5	Bodies of water	NO		X	X		
6	Atmosphere	YES		X	X		X
7	Rocks, soil	NO		X	X		X
8	Ice forms	NO		X			
9	**Earth Processes**	NO	X				X
10	Weather & climate	YES		X	X		X
11	Physical & Chemical Cycles	YES		X	X		X
12	Constructive and Destructive Processes	NO		X	X		X
13	Earth's history	NO		X	X		X
14	**Earth and the Universe**	NO		X			
15	Earth, sun, moon	YES	X	X	X		X
16	Planets in the solar system	YES	X	X			X
17	Beyond the solar system	NO		X			X
18	Evolution of the universe	NO		X			
19	Motion/location of celestial bodies	NO		X	X		X
20	**Life Sciences**	NO		X			
21	**Diversity, Organization and Structure of Living Things**	YES	X	X	X	X	X
22	Plants	NO			X		X
23	Animals	NO			X		X

		Grade Spans 7-10					
Number	**Text**	**Core >66%**	**Economy 1***	**Economy 2***	**Economy 3***	**Economy 4***	**Economy 5***
24	Other organisms	NO			X	X	X
25	Systems, organs, tissues	YES		X	X	X	X
26	Cells	YES	X	X	X	X	X
27	**Life Processes and Systems Enabling Life Functions**	NO	X				
28	Energy handling, biochemistry of systems	YES		X	X	X	X
29	Sensing and responding	NO		X	X		X
30	Biochemical processes in cells	NO		X	X	X	X
31	**Life Spirals, Genetic Continuity and Diversity**	NO					
32	Life cycles	YES	X	X	X	X	X
33	Reproduction	YES		X	X	X	X
34	Variation and inheritance	YES	X	X		X	X
35	Population genetics, biotechnology	NO	X	X			
36	Evolution, speciation, diversity	NO		X	X	X	
37	Biochemistry of genetics	YES	X	X	X	X	X
38	Genetic engineering	NO					
39	**Interactions of Living Things**	NO			X		X
40	Biomes & ecosystems	YES	X	X		X	X
41	Habitats & niches	YES		X	X	X	X
42	Interdependence of life	NO		X	X		X
43	Food webs, adaptations to habitats	NO		X		X	X
44	Competition among organisms	NO				X	X
45	Animal behavior	NO			X		X
46	Needs of living things	YES	X	X	X	X	X
47	**Human Biology and Health**	YES	X	X	X	X	X

Grade Spans 7-10							
Number	**Text**	**Core >66%**	**Economy 1***	**Economy 2***	**Economy 3***	**Economy 4***	**Economy 5***
48	Human Nutrition	NO	X		X		X
49	Human Disease and health	NO		X	X		X
50	**Physical Sciences**	NO					
51	**Matter**	NO					X
52	Classification of matter	YES	X	X	X	X	X
53	Physical properties	YES	X	X	X	X	X
54	Chemical properties	YES	X	X	X	X	X
55	Acids, Bases, Salts	NO		X	X	X	
56	**Structure of Matter**	NO					X
57	Atoms, ions, molecules	YES		X	X	X	X
58	Formulas/Equations/Nomenclature, Stoichiometry	NO		X	X	X	X
59	Macromolecules	NO			X		
60	Subatomic particles	NO		X		X	X
61	**Energy and Physical Processes**	NO					X
62	Energy types, conversions, sources	YES	X	X	X	X	X
63	Work, Power, Simple machines	YES	X	X	X	X	X
64	Heat and temperature	YES		X	X	X	X
65	Wave phenomena	NO		X	X		X
66	Sound & vibration	NO		X	X		X
67	Light	YES		X	X	X	X
68	Electricity	YES		X	X	X	X
69	Magnetism/electromagnetism	YES		X	X	X	X
70	**Physical Transformations**	NO					X
71	Physical changes	YES		X	X	X	X

	Grade Spans 7-10						
Number	**Text**	**Core >66%**	**Economy 1***	**Economy 2***	**Economy 3***	**Economy 4***	**Economy 5***
72	Explanations of physical changes	**NO**		X	X	X	X
73	Kinetic-molecular theory	NO			X		
74	Quantum theory & fundamental particles	NO					
75	**Chemical Transformations**	NO					X
76	Chemical changes	**YES**	X	X	X		X
77	Definition & evidence of chemical change	**YES**		X	X	X	X
78	Types of reactions	**YES**	X	X	X	X	X
79	Law of Conservation of Matter	NO		X			X
80	Explanations of chemical changes	NO					X
81	Determinants/trends of chemical reactivity	NO				X	
82	Rate of change and equilibria	NO		X	X		
83	Energy and chemical change	NO			X		
84	Calorimetry, exothermic/endothermic reactions	NO			X		
85	First law of thermodynamics	**NO**	X	X		X	X
86	Second law of thermodynamics	NO		X			
87	Organic & biochemical changes	NO			X		
88	Nuclear chemistry	NO					X
89	Electrochemistry	NO		X	X		X
90	**Forces and Motion**	NO					
91	Types of forces	NO					X
92	Contact forces and forces acting at a distance	**NO**	X	X	X	X	
93	Pressure - force applied to a surface	NO			X	X	
94	Time, space and motion	NO			X	X	
95	Measurement of time/space/mass	NO			X	X	X

Grade Spans 7-10							
Number	**Text**	**Core >66%**	**Economy 1***	**Economy 2***	**Economy 3***	**Economy 4***	**Economy 5***
96	Types of motion/describing motion	**NO**		X	X	X	X
97	Frames of reference	**NO**					X
98	Dynamics of motion	**YES**	X	X	X	X	X
99	Relativity theory	**NO**					
100	Air/fluid behavior	**NO**		X		X	X
101	**Science, Technology and Mathematics**	**NO**					
102	Nature or Conceptions of Technology	**YES**	X	X	X	X	X
103	Interactions of Science, Mathematics, & Technology	**NO**	X				
104	Mathematics, technology influence on science	**NO**	X	X			
105	Science applications in mathematics, technology	**YES**	X	X		X	X
106	Interactions of Science, Technology and Society	**NO**	X		X		
107	Influence of science, technology on society	**YES**	X	X		X	X
108	Influence of society on science, technology	**NO**	X	X		X	X
109	**History of Science and Technology**	**NO**		X	X	X	X
110	**Environmental and Resource Issues Related to Science**	**NO**	X				X
111	Pollution - Causes and Treatment	**YES**	X	X	X		X
112	Land, Water, Sea Resource Conservation	**YES**	X	X	X	X	X
113	Material & Energy Resource Conservation	**YES**	X	X	X	X	X
114	World Population	**NO**	X	X	X		
115	Food Production, Storage	**YES**	X	X	X		X

Grade Spans 7-10							
Number	**Text**	**Core >66%**	**Economy 1***	**Economy 2***	**Economy 3***	**Economy 4***	**Economy 5***
116	Effects of Natural Disasters	NO	X	X			
117	**Nature of Science**	NO					
118	Nature of Scientific Knowledge	YES	X	X	X	X	X
119	The Scientific Enterprise	YES	X	X	X	X	X
120	**Science and Other Disciplines**	NO					
121	Science & Mathematics	NO					
122	Science and Other Disciplines	NO					X

Grade Spans 7-10							
Number	**Text**	**Core >66%**	**Economy 6**	**Economy 7**	**Economy 8**	**Economy 9**	**Economy 10**
1	**Earth Sciences**	NO					
2	**Earth Features**	NO			X	X	
3	Earth's composition	NO	X	X		X	
4	Landforms	NO	X	X			
5	Bodies of water	NO	X	X	X		
6	Atmosphere	YES	X	X	X	X	
7	Rocks, soil	NO		X	X	X	
8	Ice forms	NO				X	
9	**Earth Processes**	NO	X			X	
10	Weather & climate	YES	X	X	X	X	
11	Physical & Chemical Cycles	YES	X	X	X	X	
12	Constructive and Destructive Processes	NO		X		X	X
13	Earth's history	NO		X	X	X	X
14	**Earth and the Universe**	NO			X	X	

Grade Spans 7-10							
Number	Text	Core >66%	Economy 6	Economy 7	Economy 8	Economy 9	Economy 10
15	Earth, sun, moon	YES	X	X	X	X	X
16	Planets in the solar system	YES	X	X	X	X	
17	Beyond the solar system	NO	X		X	X	
18	Evolution of the universe	NO	X		X	X	X
19	Motion/location of celestial bodies	NO			X	X	
20	**Life Sciences**	NO					
21	**Diversity, Organization and Structure of Living Things**	YES	X		X	X	X
22	Plants	NO	X		X		
23	Animals	NO	X		X		
24	Other organisms	NO	X		X		
25	Systems, organs, tissues	YES	X	X	X	X	X
26	Cells	YES	X	X	X	X	X
27	**Life Processes and Systems Enabling Life Functions**	NO	X			X	
28	Energy handling, biochemistry of systems	YES		X	X	X	
29	Sensing and responding	NO		X	X	X	X
30	Biochemical processes in cells	NO			X	X	
31	**Life Spirals, Genetic Continuity and Diversity**	NO				X	
32	Life cycles	YES	X	X	X	X	
33	Reproduction	YES	X	X	X	X	
34	Variation and inheritance	YES	X	X	X		X
35	Population genetics, biotechnology	NO	X		X	X	
36	Evolution, speciation, diversity	NO	X	X	X		X

		Grade Spans 7-10					
Number	**Text**	**Core >66%**	**Economy 6**	**Economy 7**	**Economy 8**	**Economy 9**	**Economy 10**
37	Biochemistry of genetics	YES	X			X	
38	Genetic engineering	NO					
39	**Interactions of Living Things**	NO	X	X			
40	Biomes & ecosystems	YES	X		X	X	
41	Habitats & niches	YES	X	X	X	X	X
42	Interdependence of life	NO	X		X	X	X
43	Food webs, adaptations to habitats	NO		X	X	X	X
44	Competition among organisms	NO		X	X	X	
45	Animal behavior	NO			X		
46	Needs of living things	YES	X	X	X	X	
47	**Human Biology and Health**	YES	X		X	X	
48	Human Nutrition	NO			X		
49	Human Disease and health	NO			X		
50	**Physical Sciences**	NO	X				
51	**Matter**	NO	X		X	X	
52	Classification of matter	YES	X	X	X	X	
53	Physical properties	YES	X	X	X	X	X
54	Chemical properties	YES	X	X	X	X	X
55	Acids, Bases, Salts	NO		X	X	X	
56	**Structure of Matter**	NO	X		X	X	
57	Atoms, ions, molecules	YES	X	X	X	X	
58	Formulas/Equations/Nomenclature, Stoichiometry	NO			X	X	
59	Macromolecules	NO	X				
60	Subatomic particles	NO	X			X	

INDIVIDUAL ECONOMY PROFILES
SCIENCE

Grade Spans 7-10							
Number	**Text**	**Core >66%**	**Economy 6**	**Economy 7**	**Economy 8**	**Economy 9**	**Economy 10**
61	**Energy and Physical Processes**	NO	X				
62	Energy types, conversions, sources	YES		X	X	X	X
63	Work, Power, Simple machines	YES			X	X	
64	Heat and temperature	YES		X	X	X	X
65	Wave phenomena	NO	X		X	X	X
66	Sound & vibration	NO	X	X	X		X
67	Light	YES	X		X	X	X
68	Electricity	YES	X		X	X	X
69	Magnetism/electromagnetism	YES		X	X	X	X
70	**Physical Transformations**	NO	X				X
71	Physical changes	YES		X	X	X	X
72	Explanations of physical changes	NO			X	X	X
73	Kinetic-molecular theory	NO		X	X		X
74	Quantum theory & fundamental particles	NO					
75	**Chemical Transformations**	NO	X		X		X
76	Chemical changes	YES	X		X	X	X
77	Definition & evidence of chemical change	YES		X	X	X	
78	Types of reactions	YES			X	X	
79	Law of Conservation of Matter	NO					X
80	Explanations of chemical changes	NO	X		X		X
81	Determinants/trends of chemical reactivity	NO					
82	Rate of change and equilibria	NO	X		X	X	
83	Energy and chemical change	NO	X				
84	Calorimetry, exothermic/endothermic reactions	NO					

		Grade Spans 7-10					
Number	**Text**	**Core >66%**	**Economy 6**	**Economy 7**	**Economy 8**	**Economy 9**	**Economy 10**
85	First law of thermodynamics	NO		X		X	X
86	Second law of thermodynamics	NO					
87	Organic & biochemical changes	NO				X	
88	Nuclear chemistry	NO		X			
89	Electrochemistry	NO	X				
90	**Forces and Motion**	NO	X			X	
91	Types of forces	NO	X		X		X
92	Contact forces and forces acting at a distance	NO		X	X		X
93	Pressure - force applied to a surface	NO			X	X	
94	Time, space and motion	NO	X		X		
95	Measurement of time/space/mass	NO		X	X		
96	Types of motion/describing motion	NO		X		X	
97	Frames of reference	NO					
98	Dynamics of motion	YES	X	X	X	X	X
99	Relativity theory	NO					
100	Air/fluid behavior	NO			X	X	
101	**Science, Technology and Mathematics**	NO					
102	Nature or Conceptions of Technology	YES	X		X	X	
103	Interactions of Science, Mathematics, & Technology	NO			X	X	
104	Mathematics, technology influence on science	NO				X	
105	Science applications in mathematics, technology	YES	X		X	X	
106	Interactions of Science, Technology and Society	NO	X		X	X	

		Grade Spans 7-10					
Number	**Text**	**Core >66%**	**Economy 6**	**Economy 7**	**Economy 8**	**Economy 9**	**Economy 10**
107	Influence of science, technology on society	YES	X	X	X	X	X
108	Influence of society on science, technology	NO			X	X	X
109	**History of Science and Technology**	NO			X	X	X
110	**Environmental and Resource Issues Related to Science**	NO	X			X	
111	Pollution - Causes and Treatment	YES	X	X	X		X
112	Land, Water, Sea Resource Conservation	YES	X	X	X		X
113	Material & Energy Resource Conservation	YES	X	X	X	X	X
114	World Population	NO	X	X	X		X
115	Food Production, Storage	YES	X	X		X	X
116	Effects of Natural Disasters	NO	X			X	
117	**Nature of Science**	NO					
118	Nature of Scientific Knowledge	YES	X		X	X	X
119	The Scientific Enterprise	YES	X		X	X	X
120	**Science and Other Disciplines**	NO					
121	Science & Mathematics	NO			X	X	
122	Science and Other Disciplines	NO			X	X	

Grade Spans 10-12: Biology						
Number	**Text**	**Economy 1**	**Economy 2**	**Economy 3**	**Economy 4**	**Economy 5**
1.	**Earth Sciences**					
2.	**Earth Features**					
3.	Earth's composition					
4.	Landforms				X	
5.	Bodies of water					
6.	Atmosphere					
7.	Rocks, soil					
8.	Ice forms					
9.	**Earth Processes**					
10.	Weather & climate			X	X	
11.	Physical & Chemical Cycles	X				
12.	Constructive and Destructive Processes					
13.	Earth's history				X	
14.	**Earth and the Universe**					
15.	Earth, sun, moon	X				
16.	Planets in the solar system					
17.	Beyond the solar system					
18.	Evolution of the universe					
19.	Motion/location of celestial bodies					
20.	**Life Sciences**	X				X
21.	**Diversity, Organization and Structure of Living Things**	X	X	X	X	
22.	Plants	X	X	X	X	X

Grade Spans 10-12: Biology						
Number	**Text**	**Economy 1**	**Economy 2**	**Economy 3**	**Economy 4**	**Economy 5**
23.	Animals	X	X	X	X	X
24.	Other organisms	X	X	X	X	X
25.	Systems, organs, tissues	X	X	X	X	X
26.	Cells	X	X	X	X	X
27.	**Life Processes and Systems Enabling Life Functions**	X		X		
28.	Energy handling, biochemistry of systems	X	X	X	X	X
29.	Sensing and responding	X	X	X	X	X
30.	Biochemical processes in cells	X	X	X	X	X
31.	**Life Spirals, Genetic Continuity and Diversity**					X
32.	Life cycles	X	X	X	X	X
33.	Reproduction	X	X	X	X	X
34.	Variation and inheritance	X	X	X	X	X
35.	Population genetics, biotechnology	X		X	X	X
36.	Evolution, speciation, diversity	X	X	X	X	X
37.	Biochemistry of genetics	X	X	X	X	X
38.	Genetic engineering	X	X	X	X	X
39.	**Interactions of Living Things**			X		X
40.	Biomes & ecosystems	X	X	X	X	X
41.	Habitats & niches	X	X	X	X	X
42.	Interdependence of life	X	X	X		X

Grade Spans 10-12: Biology						
Number	**Text**	**Economy 1**	**Economy 2**	**Economy 3**	**Economy 4**	**Economy 5**
43.	Food webs, adaptations to habitats	X	X	X	X	X
44.	Competition among organisms	X	X	X	X	X
45.	Animal behavior				X	
46.	Needs of living things	X	X	X	X	X
47.	**Human Biology and Health**	X	X	X	X	
48.	Human Nutrition	X	X	X	X	
49.	Human Disease and health	X	X	X	X	X
50.	**Physical Sciences**					
51.	**Matter**					
52.	Classification of matter					
53.	Physical properties					
54.	Chemical properties					
55.	Acids, Bases, Salts					
56.	**Structure of Matter**					
57.	Atoms, ions, molecules					
58.	Formulas/Equations/Nomenclature, Stoichiometry					
59.	Macromolecules					
60.	Subatomic particles					
61.	**Energy and Physical Processes**					
62.	Energy types, conversions, sources					
63.	Work, Power, Simple machines					
64.	Heat and temperature					

Grade Spans 10-12: Biology						
Number	**Text**	**Economy 1**	**Economy 2**	**Economy 3**	**Economy 4**	**Economy 5**
65.	Wave phenomena					
66.	Sound & vibration					
67.	Light					
68.	Electricity					
69.	Magnetism/electromagnetism					
70.	**Physical Transformations**					
71.	Physical changes					
72.	Explanations of physical changes					
73.	Kinetic-molecular theory					
74.	Quantum theory & fundamental particles					
75.	**Chemical Transformations**					
76.	Chemical changes					
77.	Definition & evidence of chemical change					
78.	Types of reactions					
79.	Law of Conservation of Matter					
80.	Explanations of chemical changes					
81.	Determinants/trends of chemical reactivity					
82.	Rate of change and equilibria				**X**	
83.	Energy and chemical change					

Grade Spans 10-12: Biology						
Number	**Text**	**Economy 1**	**Economy 2**	**Economy 3**	**Economy 4**	**Economy 5**
84.	Calorimetry, exothermic/endothermic reactions					
85.	First law of thermodynamics					
86.	Second law of thermodynamics					
87.	Organic & biochemical changes	X				
88.	Nuclear chemistry					
89.	Electrochemistry					
90.	**Forces and Motion**					
91.	Types of forces					
92.	Contact forces and forces acting at a distance					
93.	Pressure - force applied to a surface					
94.	Time, space and motion					
95.	Measurement of time/space/mass			X		
96.	Types of motion/describing motion					
97.	Frames of reference					
98.	Dynamics of motion					
99.	Relativity theory					
100.	Air/fluid behavior					
101.	**Science, Technology and Mathematics**					
102.	Nature or Conceptions of Technology	X		X	X	

Grade Spans 10-12: Biology						
Number	**Text**	**Economy 1**	**Economy 2**	**Economy 3**	**Economy 4**	**Economy 5**
103.	Interactions of Science, Mathematics, & Technology					
104.	Mathematics, technology influence on science	X			X	
105.	Science applications in mathematics, technology	X			X	
106.	Interactions of Science, Technology and Society			X		
107.	Influence of science, technology on society	X		X	X	
108.	Influence of society on science, technology	X			X	
109.	**History of Science and Technology**	X	X	X	X	
110.	**Environmental and Resource Issues Related to Science**	X		X	X	X
111.	Pollution - Causes and Treatment	X	X	X	X	
112.	Land, Water, Sea Resource Conservation	X	X	X	X	
113.	Material & Energy Resource Conservation	X	X			
114.	World Population	X	X		X	
115.	Food Production, Storage	X	X	X	X	
116.	Effects of Natural Disasters		X		X	

Grade Spans 10-12: Biology						
Number	**Text**	**Economy 1**	**Economy 2**	**Economy 3**	**Economy 4**	**Economy 5**
117.	**Nature of Science**					
118.	Nature of Scientific Knowledge	X		X	X	X
119.	The Scientific Enterprise	X	X	X	X	
120.	**Science and Other Disciplines**					
121.	Science & Mathematics					
122.	Science and Other Disciplines					

APPENDIX F: PERFORMANCE SKILL DATA
MATHEMATICS

In addition to the content, Achieve also analyzed the performance, or cognitive skill, expectations of the standards from the 12 economies in this study. Our goal was to determine the balance of basic skills, such as recall and advanced skills, such as applying advanced mathematical reasoning, across all economies.

Level of Cognitive Demand	1-6 Average	7-9 Average	10-12 Average	Low end of range	High end of range
Recall	36%	42%	33%	33%	42%
Representing	8%	7%	4%	4%	7%
Recognizing equivalents	9%	6%	3%	3%	6%
Recalling mathematical objects and properties	11%	18%	13%	11%	18%
Using vocabulary and notation	8%	11%	12%	8%	12%
Using Routine Procedures and Tools to Solve Problems	46%	37%	40%	37%	40%
Using equipment	0%	0%	0%	0%	0%
Using instruments, for example, measuring instruments	3%	2%	0%	0%	2%
Using computational devices	0%	3%	1%	0%	3%
Performing routine procedures	0%	0%	0%	0%	0%
Counting	3%	0%	1%	0%	1%
Computing	17%	12%	8%	8%	12%
Graphing	0%	2%	5%	0%	5%
Transforming	1%	5%	9%	1%	9%
Measuring	5%	2%	0%	0%	2%
Solving	6%	4%	5%	4%	5%
Predicting	2%	1%	2%	1%	2%
Relating representations	2%	3%	7%	2%	7%
Describing/discussing	7%	3%	2%	2%	3%
Using More Complex Procedures and Conceptual Understandings to Solve Problems	14%	9%	11%	9%	11%
Using more complex procedures	0%	0%	0%	0%	0%

Level of Cognitive Demand	1-6 Average	7-9 Average	10-12 Average	Low end of range	High end of range
Estimating	5%	2%	1%	1%	2%
Using data	3%	4%	5%	3%	5%
Comparing	5%	2%	2%	2%	2%
Classifying	1%	1%	2%	1%	2%
Formulating Problems and Strategizing/Critiquing Solution Methods	4%	9%	13%	4%	13%
Formulating and clarifying problems and situations	2%	7%	11%	2%	11%
Developing strategy	1%	0%	1%	0%	1%
Verifying	1%	1%	1%	1%	1%
Developing notation and vocabulary	0%	0%	0%	0%	0%
Critiquing	0%	1%	1%	0%	1%
Applying Advanced Reasoning Skills	1%	3%	4%	1%	4%
Developing algorithms	0%	0%	1%	0%	1%
Generalizing	0%	1%	1%	0%	1%
Conjecturing	0%	0%	1%	0%	1%
Justifying and proving	0%	2%	1%	0%	2%
Axiomatizing	0%	0%	0%	0%	0%
	100%	100%	100%		

APPENDIX F (CONTINUED): PERFORMANCE SKILL DATA
SCIENCE

Science performance expectations can be viewed as falling into two major categories – Science Inquiry and Science Knowledge. The Science Inquiry category is concerned with the skills essential for learning how to conduct research, whereas the Science Knowledge category includes the various kinds of performances involved in learning science content.

Level of Cognitive Demand	1-4 Average	5-6 Average	7-10 Average	Biology Average	Low End of Range	High End of Range
ACQUIRING SCIENCE KNOWLEDGE						
Recalling simple information	31%	30%	31%	26%	26%	31%
Accessing information	2%	3%	2%	2%	2%	3%
ACQUIRING KNOWLEDGE	33%	33%	32%	28%	28%	33%
INTERPRETING SCIENCE KNOWLEDGE						
Comprehending complex information	19%	18%	25%	31%	18%	31%
Organizing and representing data	4%	3%	3%	4%	3%	4%
Interpreting data	2%	2%	2%	1%	1%	2%
Processing and sharing information	4%	4%	1%	3%	1%	4%
INTERPRETING KNOWLEDGE	29%	27%	31%	40%	27%	40%
APPLYING SCIENCE KNOWLEDGE						
Applying scientific principles to solve quantitative problems	1%	0%	2%	1%	0%	2%
Applying scientific principles to develop explanations	1%	2%	3%	1%	1%	3%
Using science and technology principles to solve practical problems	2%	2%	1%	0%	0%	2%
	4%	4%	6%	3%	3%	6%

Level of Cognitive Demand	1-4 Average	5-6 Average	7-10 Average	Biology Average	Low End of Range	High End of Range
APPLYING KNOWLEDGE						
ANALYZING SCIENCE KNOWLEDGE						
Understanding thematic information	0%	0%	1%	5%	0%	5%
Constructing, interpreting, and applying models	3%	3%	2%	2%	2%	3%
Making decisions	1%	2%	1%	1%	1%	2%
Engaging in reasoned debate	0%	1%	1%	4%	0%	4%
ANALYZING KNOWLEDGE	4%	6%	6%	11%	4%	11%
CONSTRUCTING SCIENCE KNOWLEDGE						
Abstracting and deducing scientific principles	3%	4%	2%	0%	0%	4%
CONSTRUCTING KNOWLEDGE	3%	4%	2%	0%	0%	4%
SCIENTIFIC INQUIRY (RESEARCH)						
BASIC SKILLS						
Using apparatus, equipment, and computers	5%	5%	4%	1%	1%	5%
Conducting routine experimental operations	7%	8%	7%	5%	5%	8%
Gathering data	9%	7%	6%	4%	4%	9%
BASIC INQUIRY SKILLS	21%	20%	17%	11%	11%	21%
ADVANCED SKILLS						
Identifying questions to investigate	1%	2%	2%	1%	1%	2%
Designing investigations	1%	2%	2%	3%	1%	3%
Conducting investigations	1%	1%	1%	1%	1%	1%
Interpreting investigational data	1%	1%	0%	1%	0%	1%
Formulating conclusions from investigational data	1%	1%	1%	1%	1%	1%

Level of Cognitive Demand	1-4 Average	5-6 Average	7-10 Average	Biology Average	Low End of Range	High End of Range
ADVANCED INQUIRY SKILLS	6%	7%	6%	8%	6%	8%

APPENDIX G: THE CODING FRAMEWORK

The strands (large categories) and codes (numbered statements) for content and performance skills were developed at Michigan State University with participation of subject matter experts from many countries, as part of the Survey of Mathematics and Science Survey (SMSO). The frameworks (mathematics and science) were later adapted for use in the Third International Mathematics and Science Study (TIMSS)[13], initiated by the International Association for the Evaluation of Education Achievement (IEA) in 1995.

The frameworks were designed to represent the aggregate of possible content and performance skills taught in the 40 plus economies that participated in their development. Furthermore, the tool has been used to analyze educational materials internationally and has undergone refinement throughout that process. Since 1998, Achieve has used this procedure to analyze curricular documents for a variety of projects. The framework's versatility accommodates diverse research undertakings that have fulfilled a range of objectives, from comparison of standards to the writing of more rigorous standards to characterizing high school exit exams and college entrance exams.

The Coding Process

Several checks and balances were put into place to assure inter-rater reliability in coding. The first step was to code a set of standards together in order to norm coding practices. Thereafter, a single coder from a team content of experts in mathematics and science coded a set of standards, obtaining input from others as questions arose. A trained expert from Michigan State University regularly reviewed both samples of the coding from each coder and the distribution of codes to search of patterns of bias, reconciling any differences in judgment in order to attain consensus. Finally, content area experts from each economy were invited to review the coding and submit questions and disagreements. Achieve's coding team and Michigan State University experts reviewed these comments, making final decisions about any changes in the coding.

Achieve generally analyzed only the segments of the standards containing content and the performance expectations embedded in those content statements. Coders coded only what was obvious and evident in the printed content statement. In some economies' standards, explanatory notes expanding on the intent of the standard are included and were considered as supplementary information, but not necessarily coded. Coders avoided interpretation and inference about what a student might have to do to fulfill the standard, only selecting codes that applied directly to the language in the standard or codes based on additional information in the explanatory notes.

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[13] TIMSS is now Trends in International Mathematics and Science Study

Most single standard statements were coded with up to five content codes and up to five performance codes in order to capture the full range of the material covered by each standard. In some rare cases, coders applied up to eight content or performance codes to assure complete coverage of the included material.

Content Analysis

Achieve analyzed the topics covered by each economy to determine the overlapping topics between economies. Topics addressed by 67 percent or more of the participating economies in their standards at the each grade span constitute the common set of topics.

At each grade span for both mathematics and science, Achieve also conducted a calculation of the degree of overlap between each economy's content standards and the common set of topics. The overlap between the economy's standards and the common set of topics is represented by the percentage of the total number of topics from the framework addressed in that economy's standards that belong to the common set of topics at that grade span.

Performance Analysis

All performance demands written into the content standards were coded; if a standard contained multiple discrete performance demands, each one was taken into consideration and counted. Therefore, the analysis for performance skills depicts the relative emphasis on a certain skill or category of cognitive demand, as opposed to simple coverage or omission of individual skills.

APPENDIX H: PERFORMANCE SKILL HIERARCHIES
MATHEMATICS

Performance expectations from the coding taxonomy have been grouped into a hierarchy of levels approximating increasing levels of cognitive demand. The levels, in increasing order of cognitive demand are:

6. Recall
7. Using routine procedures and tools to solve problems
8. Using more complex procedures and conceptual understanding to solve problems
9. Formulating problems and strategizing/critiquing solution methods
10. Applying advanced reasoning skills

Performance Levels	
Level 1. Recall	
2.1	Knowing
2.1.1	Representing
2.1.2	Recognizing equivalents
2.1.3	Recalling mathematical objects and properties
2.5.1	Using vocabulary and notation
Level 2. Using Routine Procedures & Tools	
2.2.1	Using equipment
2.2.1.1	Using instruments, for example, measuring instruments
2.2.1.2	Using computational devices
2.2.2	Performing routine procedures
2.2.2.1	Counting
2.2.2.2	Computing
2.2.2.3	Graphing
2.2.2.4	Transforming

Performance Levels	
2.2.2.5	Measuring
2.3.3	Solving
2.3.4	Predicting
2.5.2	Relating representations
2.5.3	Describing/discussing
Level 3. Using More Complex Procedures	
2.2.3	Using more complex procedures
2.2.3.1	Estimating
2.2.3.2	Using data
2.2.3.3	Comparing
2.2.3.4	Classifying
Level 4. Formulating, Strategizing & Critiquing	
2.3.1	Formulating and clarifying problems and situations
2.3.2	Developing strategy
2.3.5	Verifying
2.4.1	Developing notation and vocabulary
2.5.4	Critiquing
Level 5. Advanced Reasoning	
2.4.2	Developing algorithms
2.4.3	Generalizing
2.4.4	Conjecturing
2.4.5	Justifying and proving
2.4.6	Axiomatizing

APPENDIX H (CONTINUED): PERFORMANCE SKILL CATEGORIES
SCIENCE

The **performance expectations included in the KNOWLEDGE category** have been grouped into levels of generally increasing cognitive demand, or rigor. These levels (or categories) of performance expectations are neither discrete nor strictly hierarchical, although there is a general increase in cognitive demand from Level 1 to Level 5. The levels are as follows:

6. Acquiring Knowledge
7. Explaining Knowledge
8. Applying Knowledge
9. Analyzing Knowledge
10. Constructing Knowledge

The **performance expectations included in the inquiry or RESEARCH category** are unique to science in that they reflect the empirical nature of science and the methodologies scientists employ in pursuit of new knowledge. (These skills are distinct from those delineated in the Science Knowledge category, described below, although there is certainly overlap. Evidence-based reasoning, for example, is characteristic of both categories.) Inquiry skills are divided into two sub-categories:

3. Basic Inquiry Skills
4. Advanced Inquiry Skills

SCIENTIFIC KNOWLEDGE	**SCIENTIFIC INQUIRY (RESEARCH) SKILLS**

ACQUIRING KNOWLEDGE
    2.1.1   Recalling simple information
    2.5.1   Accessing information
	BASIC SKILLS
	    2.3.3 Gathering data
	    2.3.1 Using apparatus, equipment, and computers
	    2.3.2 Conducting routine experimental operations

SCIENTIFIC KNOWLEDGE	SCIENTIFIC INQUIRY (RESEARCH) SKILLS
INTERPRETING KNOWLEDGE 2.1.2 Comprehending complex information 2.3.4 Organizing and representing data 2.3.5 Interpreting data 2.5.2 Processing and sharing information	**ADVANCED SKILLS** 2.4.1 Identifying questions to investigate 2.4.2 Designing investigations 2.4.3 Conducting investigations 2.4.4 Interpreting investigational data 2.4.5 Formulating conclusions from investigational data
APPLYING KNOWLEDGE 2.2.2 Applying scientific principles to solve quantitative problems 2.2.3 Applying scientific principles to develop explanations 2.2.6 Using science and technology principles to solve practical problems	
ANALYZING KNOWLEDGE 2.1.3 Understanding thematic information 2.2.4 Constructing, interpreting, and applying models 2.2.5 Making decisions 2.5.3 Engaging in reasoned debate	
CONSTRUCTING KNOWLEDGE 2.2.1 Abstracting and deducing scientific principles	

APPENDIX I: BIOGRAPHIES OF ACHIEVE CONSULTANTS

JOSEPH ACCONGIO

Joseph Accongio is a consultant and the former principal/superintendent of the Charter School of Science and Technology in Rochester, N.Y. He was also the school's Director of Program Development and primary charter recipient. He has been principal of both the Nathaniel Rochester Community School and Thomas Jefferson Middle School, as well as the House Administrator of the Discovery Magnet. In addition, Dr. Accongio was a curriculum coordinator/science teacher, a chemistry teacher, and a biology teacher in the Rochester City School District. Dr. Accongio spent a year as Director of School Services with the Children's Television Workshop, creators of *Sesame Street*, *3-2-1 Contact*, and *Square One TV*. He developed a series of teachers' guides for the science and mathematics shows and conducted numerous workshops on utilizing these popular shows in the classroom. Dr. Accongio also co-authored a monograph on science assessment entitled "Classroom Assessment—Key to Reform in Science Education." He received a doctorate in curriculum planning from the State University of New York (SUNY) at Buffalo, a master's degree in education from SUNY at Brockport, and a bachelor's degree in general sciences from the University of Rochester.

MELANIE ALKIRE

Melanie Alkire is currently a mathematics consultant with Achieve, Inc. and a site visitor and higher level mathematics assistant examiner for International Baccalaureate North America. Beginning in 1994, Ms. Alkire contributed to the design and implementation of the Oregon University System's framework of standards and assessments for admission to the seven public university campuses called PASS (Proficiency-based Admissions Standards System). In this project she served as Lead Teacher, Assessment Moderator and Site Coordinator, and was also involved in the writing and implementation of proficiencies in mathematics, as well as project evaluation and training and professional development of mathematics faculty and high school teachers. She retired in 2005 from Portland Public Schools where she served as a mathematics teacher, department chair, International Studies Coordinator, and International Baccalaureate Coordinator. Ms. Alkire received an AB in Mathematics/Education from Northwest Nazarene University and a MAT in Mathematics/Education from Lewis and Clark College.

SUSAN K. EDDINS

Susan K. Eddins taught students in kindergarten through college for over 30 years. She is the recipient of several honors for her teaching, including the Presidential Award for Excellence in Mathematics Teaching, and she is a National Board Certified Teacher in Adolescent and Young Adult Mathematics. Ms. Eddins is now retired having been a faculty member, an Instructional Facilitator, and the Curriculum and Assessment Leader in mathematics at the Illinois Mathematics and Science Academy, where she taught since the school's inception in 1986. She has served in leadership capacities in several professional organizations, notably as a member of the Board of Directors of the National Council of Teachers of Mathematics (NCTM). Ms. Eddins was a member of the 9–12 writing group for NCTM's *Principles and Standards for School Mathematics*. She is co-author of a chapter in NCTM's *Windows of Opportunity* and is a co-author of *UCSMP Algebra*. She is a past panel

member and editor of NCTM's *Student Math Notes* and has authored several articles in refereed journals. More recently, in addition to numerous workshops and presentations, her most extensive work has been in the area of standards development, standards review, and alignment of standards to assessments. For Achieve, she has reviewed academic standards or assessments from Alaska, Illinois, Indiana, Minnesota, New Jersey, Oregon, Pennsylvania, Texas and Washington. Ms. Eddins holds bachelor's and master's degrees in mathematics.

LAWRENCE NEAL
Lawrence Neal **has been a science teacher at East High School in Rochester, N.Y., for 9 years. He has taught middle school science and chemistry from the general level up to the AP level. During 2001-2002, Mr. Neal was one of a small group of chemistry teachers who assisted in the statewide implementation of New York State Education Department's new Core Curriculum. He is currently a participant in the College Board's 6 – 12 Science Standards Project. Mr. Neal is also a member of the Rochester City School District's Inquiry Institute, which is bringing hands-on inquiry-based science education to Rochester's classrooms from Grades K – 12. Prior to teaching, Mr. Neal retired from a 20-year career in the United States Navy as a commander. He had been active in carrier-based aviation, both as a pilot and a shipboard air operations officer. During this career, Mr. Neal developed and implemented standards-based training initiatives at the squadron, ship, and naval industrial facility levels. Mr. Neal received a bachelor's degree in General Science (Chemistry) from the University of Rochester, a master's degree in International Studies from Old Dominion University, and his teaching certification in Chemistry and General Science (7 – 12) from the State University of New York at Brockport.**

SUSAN PIMENTEL
Susan Pimentel, co-founder of StandardsWork™, a nonprofit education consultancy, specializes in standards-driven education reform. After earning a Bachelor of Science in early childhood education and a law degree from Cornell University, she served as senior policy advisor to Maryland Governor William Donald Schaefer, and subsequently as special counsel to former Superintendent John Murphy in Prince George's County, MD. For more than two decades, Sue's work has focused on helping communities, districts and states to work together to advance meaningful and enduring education reform, and champion proven tools for increasing academic rigor. She has also been involved in several national efforts, including determining the content for a new national teacher test and various work with KIPP charter schools. Recently, Sue has worked as a Senior Policy Consultant to the ADP, including shaping the analysis and final report of *Do Graduation Tests Measure Up? A Closer Look at State High School Exit Exams.* Currently, she serves as primary consultant to a multi-state adult education reform effort under the auspices of the AIR and the Office of Vocational and Adult Education; standards expert and writer on adolescent literacy for the Carnegie Corporation; and coach to educators at all levels in the state of Arizona on standards and assessment issues. In addition, Sue is in her second year of facilitating the development and implementation of content standards in the District of Columbia Public Schools.

MARY LYNN RAITH

Mary Lynn Raith received her B.S in mathematics from Indiana University at Pittsburgh and her M.Ed. in mathematics education from the University of Pittsburgh. She is recently retired from the position of Mathematics Specialist in the Division of Instructional Support of the Pittsburgh Public Schools. As such, her responsibilities included leadership roles in curriculum development, textbook selection, design of alternative assessments, in-service program design and implementation, and coordination of mathematics programs across levels and schools. Ms. Raith was also the Co-Director of the Pittsburgh Reform in Mathematics Education project (PRIME), a K – 12 professional development system. She has also been involved with a number of national projects, including the development of both the New Standards Reference Examination and the Portfolio project for the middle grades, the Assessment Communities of Teachers project (ACT), and the Alternative Assessment in Mathematics project (A^{2}IM). She has also worked extensively with both NCTM and NCEE on its America's Choice school design and has presented at numerous national conferences.

DMITRI SEALS

Dmitri Seals joined Achieve after three years of work at Maya Angelou Public Charter School in Washington, DC. As a teacher there, he served as co-chair of the math department and led curriculum development for six high-school math courses. He also founded the school's math tutoring center, its debate team, and its annual speaking competition. Starting in 2002, he served as the founding president of the Coaches Association for the District of Columbia Urban Debate League; he led his team to the league's city championships in 2005. He graduated from Brown University in 2002, with a concentration in the Politics of Media and Education. During college, he served as the only student member of the Brown Executive Committee on College Curriculum, and he co-founded a year-long Committee on Diversity in Education in 2001. In addition to his work at Achieve, he continues to lead the Math Lab and debate team at Maya Angelou Public Charter School. He also writes profiles of social entrepreneurs for the Ashoka Foundation.

CARY SNEIDER

Cary Sneider is Vice President for Educator Programs at the Museum of Science in Boston, where his current objective is to help schools implement state standards in technology and engineering. Dr. Sneider's interests have focused on helping students unravel their misconceptions in science and on new ways to link science centers and schools to promote student inquiry. His publications include teachers' guides, articles about the instructional uses of computers, and research studies on how children acquire science concepts and skills. In 1997, he received the Distinguished Informal Science Education award from NSTA and in 2003 was named National Associate of the National Academy of Sciences.

KATHLEEN WIGHT

Kathleen Wight joined the Third International Mathematics and Science Study (TIMSS) research group in May of 1997. Since that time she has done extensive document analysis of mathematics and science curriculum standards, textbooks, and assessments using the TIMSS content and performance expectation framework. Her responsibilities have included: hiring, training, and supervising personnel to assist in the document analysis process; checking data

analyses to ensure data integrity; analyzing output from the data collection and coding process; writing reports; presenting results of analyses; reviewing and preparing test items for three grade bands (elementary, MS, and HS); and compiling the associated test forms. Kathleen earned a Bachelor of Arts in Statistics from the University of Michigan (1971), and a Master of Science in Environmental Engineering from Michigan State University (1997). She worked for 18 years with Michigan Bell Telephone Company, later Ameritech, SBC, and now AT&T.

EXAMPLE

[i] **New Zealand**, Level Three, Statistics, Statistical Investigation (thinking)
Conduct investigations using the statistical enquiry cycle by:
- gathering, sorting, and displaying multivariate category data, discrete numeric data and simple time-series data to answer questions;
- identifying patterns and trends in context, within and between data sets;
- communicating findings, using data displays.

[ii] **China** – Statistics and Probability expectations for the Second Stage of Schooling (Grades 4-6). Through rich real examples, understand the meanings of mean, median and mode. Able to obtain the mean, median and mode of data, and to explain their meanings from the practical point of view. According to concrete problems, able to select appropriate statistics to reflect the different characteristics of data.

[iii] **Australia** – Year 5, Measurement, chance and data. Design chance experiments to collect data and make predictions based on that data.

[iv] **Korea**, First Grade of Lower Secondary, B Variables and Expressions, 2 Linear Equations
- Understand the meaning of a linear equation and its solution.
- Understand the property of equality, and know how to apply it.
- Solve linear equations.

[v] **China** – Equation and Inequality expectations in the Third Stage of Schooling (Grades 7-9) / ii Equation and Inequality / (i) Equation and System of Equations / (c) Able to solve equation of first degree in one unknown, simple system of equations of first degree in two unknowns, as well as to simplify these into fraction equations of first degree in one unknown.

[vi] **China** – Third State of Schooling, Number, 1.iii.b / (b) Able to draw the graph of inverse proportion function. Explore and understand the property of $y = k/x$ ($k \neq 0$) based on explication of this expression and graph of first degree function. (i.e., variation of graph when $k>0$ or $k<0$).

[vii] **Hong Kong** – Key Stage 4, 4.4.1 / formulate and solve quadratic equations by factor method and formula
- solve the equation $ax^2 + bx + c = 0$ by plotting the graph $y = ax^2 + bx + c$ and reading the x-intercepts;
- be aware of the approximate nature of the graphical method;
- choose the most appropriate strategy to solve quadratic equations;
- recognize the conditions for the nature of roots;
- understand the hierarchy of real-number system and be aware of the characteristics of rational numbers when expressed in decimals.

[viii] **Chinese Taipei** – The First Year, iii.5 / Polynomial Equations - Including the introduction of basic algebra, Bolzano's Theorem and coefficient polynomial equation imaginary root pair theorem.

[ix] **Japan** – Mathematics C, 2. Algebraic expressions and curves
    b) Parametric representations and polar coordinates
        (i) Parametric representations of curves
        (ii) Polar coordinates and polar equations

[x] **Primary Grades**
  Level 1: **Japan**, Grade 5, Numbers and calculations, 4a
- In simple cases, to notice fractions of the same size.

  Level 2: **Korea**, First Grade, Numbers and Operations, 2.1
- Understand the situations for, and the meaning of, addition and subtraction.

  Level 3: **China**, Statistics, i.i
- Able to compare, order and classify objects in accordance with specified standards or standards of one's choice (e.g. quantity, shapes, color). Experience consistency of results of these activities when standards are the same, whereas in the case of different standards experience variety of results instead.

  Level 4: **Chinese Taipei**, 6-n-10
- Utilize the common relationships between figures and quantity to properly list mathematical statements in order to solve problems and examine the rationality of the answers

  Level 5: While a very small number of standards are coded as Level 5 (among other levels), the sample is too small to warrant inclusion.

[xi] **Lower Secondary**

Level 1: **Alberta CA**, Grade 8, 1.6.6
- Express a given positive mixed number as an improper fraction and a given positive improper fraction as a mixed number.

Level 2: **China**, Year Three, Numbers and Expressions, Real Number
- [Familiar with the fact] that power and root are both inverse operations. Able to use the square root operation to evaluate the square root of a non-negative number. Able to use the cube root operation to evaluate the cube root of a number. Able to use a calculator to evaluate square root and cube root.

Level 3: **Malaysia**, Grade 9, Unit 4: Statistics II, i, iii, iv
- i. Obtain and interpret information from pie charts.
- iii. Solve problems involving pie charts.
- iv. Determine suitable representation of data.

Level 4: **Singapore**, O Level, Numbers and Algebra, Algebraic representation and formulae, bullet 4
- Translation of simple real-world situations into algebraic expressions.

Level 5: **Hong Kong**, Key Stage 3, Learning Geometry through a Deductive Approach, Simple Introduction to Deductive Geometry
- Develop an intuitive idea of deductive reasoning by presenting proofs of geometric problems relating with angles and lines

[xii] **Upper Secondary**

Level 1 – **NAEP**: Geometry, 1d
- d) Draw or sketch from a written description plane figures (e.g., isosceles triangles, regular polygons, curved figures) and planar images of three-dimensional figures (e.g., polyhedra, spheres, and hemispheres).

Level 2: **Finland**, 6, Mathematical Models II, Objective 2
- know how to solve linear programming problems relating to practical situations;

Level 3: **Thailand**, Numbers and Operations, Standard M 1.3.1
- Use estimation in computing and solving problems: find the approximate values of radicals and exponents by using appropriate strategies.

Level 4: **Japan**, Mathematics I, Quadratic Functions, 2a
- Quadratic functions: To enable students to understand quadratic functions, and to recognize the usefulness of representing the variations in numbers and quantities by using functions. To enable students to apply them to consideration of concrete phenomena and solving quadratic inequalities. a) Quadratic functions and their graphs

Level 5: **Malaysia**, Grade 10, Learning Area 5: The Straight Line, Objective 2.i.
- Understand the concept of gradient of a straight line in Cartesian coordinates - Derive the formula for the gradient of a straight line.

[xiii] **Basic Inquiry Skills**

Japan Lower Secondary: observe a magnetic field caused by a magnet and electric current, to understand that a magnetic field is expressed by means of magnetic line of force, and to know that a magnetic field is produced around a coil.

Japan Elementary: Using weights and exploring the movement of objects by changing weights and speed of moving weights, and thus, enabling children to develop ideas about regularity in the movement of objects.

Hong Kong S4-6 Chemistry: demonstrate how to prepare solutions of a required concentration by dissolving a solid or diluting a concentrated solution.

[xiv] **Advanced Inquiry Skills**

Canada 7-9: ask questions about relationships between and among observable variables and plan investigations to address those questions.

Canada Earth & Space Science: design an experiment and identify specific variables (e.g., propose and test the variables that will change the eccentricity of an ellipse, using the string-and-pin method of drawing ellipses).

Canada Physics: carry out procedures controlling the major variables and adapting or extending procedures where required (e.g., control the major variables when conducting experiments to determine the relationships between kinetic and potential energies).

Canada Physics: interpret patterns and trends in data, and infer or calculate linear and nonlinear relationships among variables (e.g., interpret trends in experimental data while verifying the inverse-square law).

Canada 7-9: state a conclusion, based on experimental data, and explain how evidence gathered supports or refutes an initial idea (e.g., explain how the evidence of convection currents in fluids supports the particle model of matter).

[xv] **Acquiring Knowledge**

Hong Kong: Physics Curriculum and Assessment Guide (Secondary 4 - 6): describe the meaning of inertia and its relationship to mass.

Canada 10-12 Life Science: select and integrate information from various print and electronic sources or from several parts of the same source (e.g., collect information on human reproductive technology from a variety of sources).

[xvi] **Explaining Knowledge**

Chinese Taipei Grades 7-9: explain the difference between atoms and molecules in components and their properties.

Singapore Biology Higher 2 Syllabus 9747: Outline the roles and functions of membranes within cells and at the surface of cells.

Finland Elementary Science: interpret physical maps, thematic maps, photographs, and statistics, and utilize news sources and information from data networks.

Canada Chemistry: communicate questions, ideas, and intentions, and receive, interpret, understand, support, and respond to the ideas of others (e.g., discuss, as a team, the procedures used in the synthesis of ASA in the laboratory).

[xvii] **Applying Knowledge**

Hong Kong: Chemistry Curriculum and Assessment Guide (Secondary 4 - 6): perform calculations related to formula masses and relative molecular masses of compounds.

Canada Chemistry: identify limitations of a given classification system and identify alternative ways of classifying to accommodate anomalies (e.g., identify the limitations of using electronegativity values to determine the polar nature of a specific covalent bond).

Canada Chemistry: identify and correct practical problems in the way a technological device or system functions (e.g., identify problems such as the determination of correct masses in stoichiometric experimentations).

[xviii] **Analyzing Knowledge**

Hong Kong: Biology Curriculum and Assessment Guide (Secondary 4 - 6): relate the use of microorganisms to pollution control.

Chinese Taipei: Required Physics: Use molecular dynamics model to explain that pressure is caused by the moving molecules of gases heating the surface of containers.

Canada Physics: propose courses of action on social issues related to science and technology, taking into account an array of perspectives, including that of sustainability (e.g., propose a course of action that addresses the issue of eliminating speed limits on four-lane highways).

Canada Grade 10 Science: defend a decision or judgment and demonstrate that relevant arguments can arise from different perspectives (e.g., present a brief for a public hearing and summarize the briefs of others on an issue related to a local environmental problem).

[xix] **Constructing Knowledge**

Singapore Chemistry: deduce the type of bonding present from given information.